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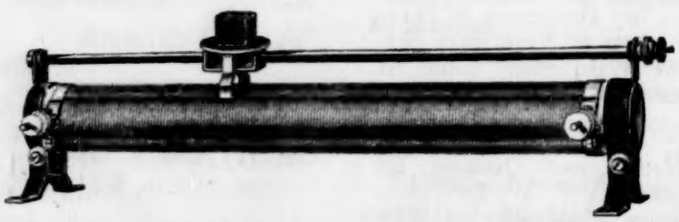

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SCIENCE

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RESEARCH IN THE MEDICAL SCIENCES[1]

THE medical sciences may be defined as including those secondary sciences which contribute directly or indirectly to preventive and curative medicine and to public health. In common with other sciences the medical sciences have both theoretical and applied aspects, and research is the underlying principle of all knowledge and advance in both. Research and theory are interdependent, theory underlies practice, and practice at its best continues to utilize and to stimulate and accomplish research. Research after all simply reflects a state of mind; that state of mind that is not satisfied with the acceptance and application of an alleged group of facts but that insists on personal verification and extension thereof. This questioning and itching type of mind is in its highest reaches inborn, but its cultivation is not only possible in normally equipped individuals, but would seem essential for the proper fulfillment of a life on the level of a profession.

THE FIELD

The medical sciences afford fields of research which yield results comparable to those that accrue from the other sciences—happiness through intellectual gratification, opportunity for human service and a livelihood. It is true that the secondary sciences that are grouped as medical are less exact than the older fundamental sciences in the sense that they are younger, less fully formulated and more complex. The last feature alone suffices to assure an even wider range of intellectual gratification than do those sciences that enjoy greater technical accuracy. To many the prolongation of life and the mitigation and prevention of physical suffering is the highest form of human service. A livelihood is now

[1] This article is one of a series on "Opportunities for a career in science" that is being prepared for the Division of Educational Relations of the National Research Council.

assured even to the teacher and investigator of medical theory. It is a matter of pride to medical scientists that discoveries in their field which are frequently of the most far reaching human importance can never, from the ethics of the profession, be utilized for personal pecuniary gain. If one is drawn to the more practical aspects of applied medicine, whether in the laboratory or at the bedside, an often generous, though seldom large, financial return is possible, coupled with opportunity for great and personal human service. Investigation may still continue under these latter conditions, although it is less likely to flourish.

THE RELATION OF THE MEDICAL SCIENCES TO THE PRACTICE OF MEDICINE

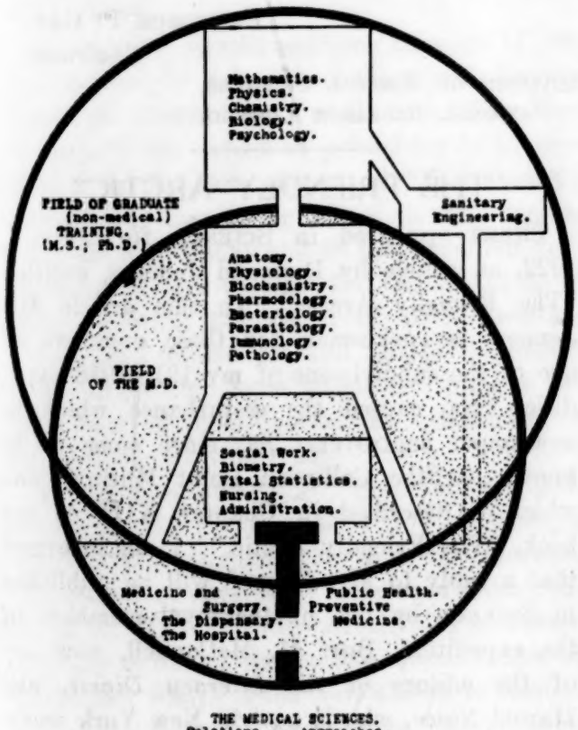
There is still a common misapprehension that the medical sciences are formulated and advanced entirely or for the most part by practitioners of medicine. In the middle ages physicians began to be dissatisfied with the explanations of the structure and function of the human body and of the nature of disease that had been handed down from Galen and Hippocrates. Certain radicals like Paracelsus began to ask themselves questions about these matters, to review the evidence in person, and to arrive at conclusions by a process of reasoning. Ratiocination in turn gave way to the methods of direct observation, and finally certain fundamental truths, as, for example, the circulation of the blood (Harvey) came to be worked out not by taking advantage of chance occurrence in the sick or well, but by deliberately planned experiments on living animals. The physician still remains the one most concerned in knowing the natural conditions of structure and function in the animal body, and particularly such modifications of them as occur in disease. Each year the physician has behind him a greater body of determined facts which enable him to understand and to modify the processes which he sees going on in his patients. Indeed, the body of facts on which his expert skill rests has become so great that his life becomes a frantic attempt to keep up with those advances which he may utilize advantageously in the treatment of disease. The increase of specialization in medicine means simply that the physician has realized that to be most effective he must focus his attention on certain types of disease or on certain localizations of disease in the body. The practitioner still sees best the gaps in present knowledge that, if filled, would enable him to understand and to counteract those manifestations of disease by which he is confronted. But the filling of these gaps with those new facts on the basis of which the practitioner acts has often been and is increasingly becoming a function of yet other groups of specialists whose interests lie in the impersonal study of animal structure and function in health and disease, apart from any practical application that may follow such information. It requires a lifetime of endeavor to acquire the technique requisite for the modern investigation of a new problem, let us say, in the normal or vitiated chemistry of the human body. This means that increasing numbers of anatomists, physiologists, biochemists, bacteriologists, parasitologists, immunologists, pathologists and others have come into being, whose daily life is occupied not with the care of the sick but with the study of conditions underlying such care. This specialization in each of the numerous medical sciences is merely a further manifestation of the advantageous division of labor.

THE TRAINING OF MEDICAL RESEARCH WORKERS

Workers in these underlying and more theoretical fields of medicine are engaged in increasing numbers not alone in eliciting new facts of eventual value in the progress to medicine but in carrying out for practitioners those diagnostic procedures which their particular branch of science has developed. The career of these workers in the laboratory sciences, therefore, include not only research and teaching but routine practice. The question now arises as to how those who choose careers in the medical sciences are actually being trained for their work and, indeed, what method of training is the best. The profession of medicine is at least moderately endowed with guild consciousness. The physician has at times been somewhat disturbed to find that the problems on the solution of which his art depends are being solved by those who have failed to follow in his footsteps through a course in medicine and through contact with the sick. The physicians of France at first vigorously re-

sented the fact that Pasteur, a mere chemist, offered certain indisputable proofs of the parasitic nature of the infectious diseases in man and animals. Even Koch, who with Pasteur founded the modern sciences of bacteriology, and himself a practitioner of medicine, made vigorous strictures on Pasteur's claim to have succeeded in preventing splenic fever (anthrax) in cattle, in view of the latter's lack of training in comparative pathology and veterinary medicine. But, fortunately, advance in science is not dependent on a pattern of training. The prepared and particular mind at work on a given problem remains the essential element in its solution. The chemist continues to be the man best fitted to attack a problem of chemistry, whether that particular problem in chemistry relates to structure of the atom or the metabolism of the diseased human body. A physician may, to be sure, be somewhat of a chemist, but it has become increasingly more difficult for one to remain an essential contributor in several scientific fields.

An attempt is made in the accompanying diagram to show the relations of the fundamental sciences of curative and preventive medicine and of public health to the medical sciences. The two enclosing circles show the respective fields for which graduate training as exemplified in higher degrees fits a prospective student. The difference in size of the circles is designed to indicate the fact that there are actually more scientific subjects of direct or indirect value to medicine for which a Ph. D. degree can and does fit a student than does the regulation medical training. Even in the practical fields of curative and preventive medicine the non-medical graduate is gradually bearing more and more of the burden, here subordinate, to be sure, to the predominating care of the sick.



THE MEDICAL SCIENCES.
Relations --- Approaches.

To be concrete, the Doctor of Philosophy in the appropriate field may be and actually does become the Professor of Anatomy, Physiology, Biochemistry, Bacteriology, Pharmacology and probably in the near future Pathology. It is needless to say that he makes contributions to each of these subjects and even with less advanced training (M. S.). In the practical fields we have, in addition to non-medical social workers, statisticians and nurses, non-medical administrators of hospital and public health enterprises, at least in lesser positions. No one would dream of looking for a sanitary engineer among medical graduates, and even non-medical epidemiologists have been utilized.

This growing importance of non-medical scientists in more or less purely medical subjects is in part due to the law of supply and demand. Doctors of Medicine are too few, their training too long and expensive, to expect that many of them will fill the less remunerative positions which theory affords as compared with practice. And apart from pecuniary regard, the personal human touch, the joy of direct human service which fortunately appeals to the majority of mankind, leads most graduates in medicine into the practical field. And, then, it must be confessed that in some respects the non-medically trained man is often better fitted both as a teacher and investigator than the medical graduate to forward the medical sciences.

To be specific, what course would we lay out for a recent graduate of a university (A. B.) who had taken a course in general bacteriology in his sophomore year, had later been permitted to take the regular course in medical bacteriology and who now plans to make bacteriology in its medical aspects his life's work? Should he proceed through the regular medical course for a period of five years to the medical

degree, or should he proceed through a shorter period of from three to four years to the Ph. D. in Bacteriology? If he is so advised and follows the first plan he will on graduation in medicine, and after a required interne service in medicine and surgery, have a general idea of human disease problems and the general relations of bacteriology to them; he will thereafter, however theoretical he may become, be able to stand unabashed in the presence of a patient and discuss symptoms with his clinical colleague, but he will be but little better as a bacteriologist than he was four years before, and, unfortunately for his first love, he will in all probability have long since ceased to wish to become one. As a successful Ph. D. on the other hand, our student will have demonstrated two years earlier his ability as an independent research worker in bacteriology, he will have made the first steps in a teaching career and he will have added something to the sum of human knowledge in his field. For better or worse the latter man is a recruit to the science he has chosen, but from the personal standpoint he is a recruit with a handicap in the eyes of his henceforth medical colleagues which he can live down only by superior ability. Such choices must after all remain for the individual to make and should and will be made in the light of what he insists on doing. At least it should be clear that a research career in the medical sciences is open both to medical and non-medical graduates.

OPPORTUNITIES FOR RESEARCH

The opportunities for these research careers in medical science are now present in many places, admixed with more or less responsibilities of a more defined or routine sort, as teaching, which is a stimulus to research, diagnosis, which by the clever mind in its most routine forms takes an investigative trend, and administrative duties. Research institutions exist for the pure investigation of any or of some particular medical problem. The universities, fortunately for their teaching, remain the fostering places of pure research while affording the constant human stimulus of contact with fresh young minds. Public health laboratories, municipal, state and federal, while largely administrative in function, always under wise guidance, afford research opportunities and, indeed, present the latest, most urgent, and, frequently, most interesting problems. Even hospital laboratories with predominating routine duties are recognizing the need of including research possibilities in order to secure a really competent personnel.

Repetition of a procedure that has been mastered is the path of least resistance, and when followed by more and more flattering administrative responsibilities with opportunity for human contact, leads in the career of many to a languishing of research. Research is recognized as a stepping stone to preferment and is frequently utilized for this purpose alone; something is accomplished even in this way to the benefit of the individual and the science. The greatest investigators are probably seldom lost in spite of difficulties that are put in their way and the seductive paths that lure them, but the rank and file of minor contributors is essential. A determination to start a career which shall include research and opportunity for its accomplishment do not suffice. An encouraging and never-failing belief in the essential necessity for research, a scholarly atmosphere, should surround the majority of beginners. Such an atmosphere usually occurs in the universities and in research institutions and only occasionally elsewhere.

FREDERICK P. GAY,
Chairman

DIVISION OF MEDICAL SCIENCES,
NATIONAL RESEARCH COUNCIL

"THE FRIENDLY ARCTIC"

THERE appeared in SCIENCE for July 7, 1922, an article by Diamond Jenness, entitled "The Friendly Arctic." In this article Mr. Jenness is spokesman for those members of one of the subdivisions of my 1913-1918 expedition who caused the disturbance which in newspaper controversy has since come to be known as "the Collinson Point Mutiny" and which is described in Chapter XIII of my book, "The Friendly Arctic." I am informed that a reply to Mr. Jenness will be published in SCIENCE by two of the loyal members of the expedition, Burt M. McConnell, now one of the editors of the *Literary Digest*, and Harold Noice, who is now in New York work-

ing up the results of his six years in the polar regions, two years as member of my expedition and four years conducting his own expedition in Coronation Gulf.

I have heretofore refused to reply to any newspaper attacks, preferring to rest my case on the vote of thanks of the Canadian government, the preface to my book written by the prime minister of Canada, and on the action of the Explorers Club of New York, the American Geographical Society, the National Geographic Society and the Minister of Mines of Canada, to all of whom the charges made by Mr. Jenness have been submitted together with numerous other charges. The replies were as follows: After consideration of the charges, the Explorers Club elected me to its presidency; the American Geographical Society gave me their Daly Medal; the National Geographic Society awarded the Grant Squires prize to "The Friendly Arctic"; the prime minister of Canada moved a vote of thanks which was passed on January 21, 1921 (nearly seven years after the charges against me were first circulated at Ottawa); and the minister of mines (the head of the department in which Mr. Jenness is employed) declined to investigate written charges submitted by Mr. Jenness and four or five of the men who had been in the section of the expedition that disobeyed instructions.

Since these attacks continue in spite of official action by scientific bodies and by the Canadian government, I shall now take notice of them to the extent of publishing in the appendix to the next edition of "The Friendly Arctic" the charges submitted to the various scientific institutions and to the Canadian government together with the full text of the documents showing the action of these societies. I shall also publish the full text of the orders of the expedition from which Mr. Jenness has made the garbled quotations published in SCIENCE for July 7, 1922.

Mr. Jenness attacks Dr. Pearl on two general grounds—his incapacity to judge of a work on polar exploration, and his ignorance of government documents other than those published in "The Friendly Arctic." Dr. Pearl's standing as one of the leading scientific men of the United States is too well known to readers of SCIENCE to need comment here. As to familiarity with polar conditions, Dr. Pearl himself states his case so clearly in the review that further comment is superfluous. But as to his alleged unfamiliarity with the documents of the expedition, I can say something here that may enlighten Mr. Jenness and interest any one who wants to form an opinion on this case. It happened that Dr. Pearl spent the summer of 1920 within half a mile of the place where I was engaged upon the final revision of "The Friendly Arctic." During that summer and previously, I had an extensive correspondence with Sir Robert Borden, who had been prime minister of Canada during the entire course of my expedition. Although the correspondence was not intended for publication, it was not so private that it might not be shown to my intimate friends. Dr. Pearl, therefore, saw the parts of the manuscript dealing with the Collinson Point mutiny, which had been read by the prime minister himself, and he saw the prime minister's signed comments on this part and the signed text of the preface which the prime minister wrote for "The Friendly Arctic." Instead of being, as Mr. Jenness alleges, unaware of the disapproval of my work by the Canadian government, he was, as a matter of fact, aware of the approval of that work by the Canadian government—for surely the written approval of the prime minister who was in charge during the entire expedition is the approval of the government. If employes of the government, such as Mr. Jenness, dissent, they do so on personal or scientific grounds and without any right to speak for the government which employs them.

VILHJALMUR STEFANSSON

In SCIENCE for July 7, 1922, there appeared an article by Diamond Jenness under the title, "The Friendly Arctic." It was ostensibly an attack upon Dr. Raymond Pearl and his review of "The Friendly Arctic" (in SCIENCE for March 24, 1922), but really an attack upon the book of that title and upon its author, Vilhjalmur Stefansson, the commander of the Canadian Arctic Expedition of 1913-1918. To any one who has read the book carefully or who knows either Pearl or Stefansson the Jenness attack will seem to need no reply. So at least it seemed to the writers of this article. But it now appears that many readers of

SCIENCE are really accepting the Jenness attack as (1) fair, (2) truthful and (3) reflecting the attitude of the government at Ottawa. Accordingly we have decided to reply to it under those three heads.

First, the parties to the dispute should be introduced.

Diamond Jenness was attached to that subdivision of the Canadian Arctic Expedition which "mutinied" against Stefansson's command. This "mutiny" is fully, fairly and (we think) too leniently described in "The Friendly Arctic." Jenness was absent when the "Collinson Point Mutiny" actually took place and did not see Stefansson after that (March, 1914) at any time during the remaining four years of the expedition. He heard about the "mutiny," therefore, only from those who had opposed Stefansson—presumably a colored view.

Burt McConnell and Harold Noice both belong to the part of the expedition that was faithful to the commander and that helped him carry out the work which Jenness criticizes. Having been loyal to the expedition and faithful in our duties, we now defend Stefansson quite as logically as Jenness attacks him.

McConnell was Stefansson's secretary from the time the expedition assembled in 1913 until about a month after the "mutiny," and took part in the early stages of the 1914 ice journey (the one which the Dr. Anderson faction—now defended by Jenness—tried to prevent Stefansson's making; the one on which he was given up as dead for a year by the expedition and the world in general, except a few, including McConnell). The lady who is now Mrs. McConnell had been Stefansson's secretary during the organization of the expedition. McConnell is, in some respects, as well informed, therefore, as Stefansson himself on incidents which occurred in Victoria and Nome months before and which led indirectly to the "mutiny." He also knows what happened then at Collinson Point and just thereafter.

Harold Noice accompanied Stefansson on two of his longest ice journeys—those of 1915 and 1916. He is therefore qualified to say whether Stefansson describes correctly in "The Friendly Arctic" his method of "living off the country" and whether it is Jenness (in SCIENCE for July 7, 1922) or Pearl (in SCIENCE for March 24, 1922) who misunderstands and misrepresents Stefansson's deeds and views.

Of the three issues raised by Jenness we shall consider first whether he expresses or represents the position taken by the Canadian government. Jenness seeks to have the reader make that inference by heading his article with "Published by permission of the Deputy Minister of Mines." Those familiar with government routine will know, however, that this does not signify that the Deputy Minister is for or against Stefansson, or has taken sides at all. It merely shows he gave Jenness (an employee of his deparment) such permission to publish as Stefansson himself, Storkerson and other members of the expedition frequently sought and received from their respective superiors while they were in government service.

That the Canadian government has permitted Storkerson (who is for Stefansson) and Jenness (who is against Stefansson) both to publish shows nothing but a liberal attitude in permitting free speech. But the government has other ways of recording its position and has done so very decisively.

Canada had two prime ministers during Stefansson's service. Sir Robert Borden was premier while the expedition was in the field, and Mr. Arthur Meighen when "The Friendly Arctic" was published. Sir Robert read the entire manuscript of "The Friendly Arctic" before it went to press, and the part dealing with the "mutiny" he read over again in galley proof before he wrote the preface. He knew what the rumors being circulated by the "mutineers" were. If the reader will turn to Sir Robert's preface he will find that those rumors are answered by the premier, though he does not mention them. It is apparent that no endorsement by a government could be stronger than that which the (at that time) premier of Canada gave to Stefansson in his preface to "The Friendly Arctic."

But the rumors against Stefansson continued being industriously circulated at Ottawa, where Dr. Anderson, Mr. Jenness and other members of the expedition reside. It was perhaps as much to set them at rest as to show the government's gratitude for important work well done that the next premier of Canada, Mr.

Meighen, moved a vote of thanks of the Canadian nation on January 21, 1921. At the end of a long and laudatory summary of Stefansson's work, the document closes:

> The committee, on the recommendation of the Right Honourable the Prime Minister, and in view of these considerations, advise that in recognition and appreciation of his distinguished services the thanks of the government of Canada be formally extended to Mr. Stefansson.

Sir Robert Borden's endorsement of Stefansson is available in any library as the preface to "The Friendly Arctic"; a copy of the vote of thanks can probably be secured free by any one who writes to the Undersecretary of State at Ottawa asking for Privy Council Document No. 2887 for January 21, 1921; an article by Jenness implying that Stefansson disobeyed government instructions, mismanaged the expedition, and is not endorsed by the government of Canada is available in the files of SCIENCE under date of July 7, 1922. It might be interesting to read and compare the three documents and then decide whether Jenness speaks for the government or whether its two premiers do.

Under the heading of whether Jenness is fair in his SCIENCE article we might ask the reader to check up on his quotations from Stefansson's writings and decide whether he does not in many cases select them so as to convey the opposite meaning of that intended by Stefansson. Take, for instance, the insinuation that Stefansson claims to have originated the method of living off the country and Jenness' citation of Rae as having done so long before. But in his "My life with the Eskimo" (pp. 304-305)), published in 1913, Stefansson says clearly that Rae lived by hunting, and praises him as a pioneer. Jenness, therefore, merely corroborates what Stefansson had said nine years earlier, although the general tenor of his article would lead the uninformed to believe he is disproving something Stefansson has asserted.

The most fundamental unfairness of the Jenness article to Pearl and Stefansson is that he very cleverly confuses one exploring method borrowed and improved upon with another which Stefansson originated, and tries to show he originated nothing by giving one name to two very different things. Stefansson's agreement with certain authorities on the one head and his disagreement with all authorities on the other is so clearly stated in Chapter XIII of "The Friendly Arctic" that no one can misunderstand. Stefansson had used for four years, with success, Rae's method and that of the Eskimos of hunting on or near land. But neither Eskimos, arctic whaling captains, explorers, nor geographers believed he would find sufficient animal life hundreds of miles from land in the Beaufort Sea to use there a similar method. This was the central issue upon which the "Collinson Point Mutiny" against Stefansson was based, and the chief reason why Stefansson was later given up for dead. When the insubordinate members of the expedition had failed to prevent his starting out on the sea ice with a plan of living a year by hunting, the story of his death arose because he did not return inside three months, for it did not seem to any but a small minority of his friends that there was any chance of his having found game to live on.

Jenness tries to confuse the reader with thinking there was and is a dispute as to who originated the method of living by hunting *on or near land.* That was invented by northern aborigines in prehistoric times. But few things called new are really more new than Stefansson's triumphantly established theory that sufficient game could be found under and on the ice *far from land.*

Jenness, with much subtlety, tries to show that Pearl and Stefansson contradict each other, and that Stefansson contradicts himself as to whether he really relied on the method of living by forage. Any one who looks up the quotations and reads both them and their context will see there is no such contradiction. For instance, Jenness quotes Stefansson: "Our own grub will be chiefly rice, fat and sugar," and apparently wants the reader to infer that Stefansson was talking about a whole journey. Any reader of "The Friendly Arctic" knows better, and especially we who were with him know better. He was talking about the food with which we always filled our sleds on starting from a ship. This we ate as fast as we felt like until it was gone, for we had full confidence in getting game after the sun came back. The food we hauled was merely to enable us to get well started

on our long journey in the early spring before there was as yet enough hunting light.

Take another instance: "Mr. Stefansson * * * wisely provided himself with three vessels loaded with all necessary supplies of pemmican, sugar, rice and other foods," says Jenness, but he neglects to point out that those ships were hundreds and sometimes a thousand miles away from where we were traveling and living by hunting, and that they were largely occupied in supplying not Stefansson but Jenness and his associates. Some of the ships were carried off in Stefansson's absence (when he was thought dead) by the Anderson-Jenness faction and against Stefansson's written orders. Furthermore, all members of the Stefansson expedition know that most of the supplies carried on these ships were originally provided to feed their crews and those members of the scientific staff who operated near a ship base—not Stefansson and his exploratory parties, who lived by hunting far away and used the ship supplies only when they were near the ships and when it happened to be less bother to do so than to hunt.

It takes too much space to trace all the adroit misquotations of the Jenness attack. Those who have the inclination can do so in "The Friendly Arctic," "My Life with the Eskimo," and Stefansson's other books.

We now go on to a consideration of whether the Jenness paper does not pass over the borderline of being merely adroitly unfair and misleading into the domain of simple untruthfulness.

There was one part of the Jenness paper that astounded us. With all our knowledge of the extent to which misrepresentation has been carried in trying to gloss over the circumstances relating to the "Collinson Point Mutiny," we did not think Jenness or any one else would dare to misquote government documents, especially those written by men still living. Accordingly, we were dumbfounded by the section of the Jenness article (p. 9 of the SCIENCE article) which purports to quote instructions given by the Honorable G. J. Desbarats, Deputy Minister of Naval Service (who, by the order-in-council which governed the expedition, was in charge of it on behalf of the government) to the effect that Stefansson was not in full command of the expedition. We thought, for a moment, that these were some instructions hitherto not published. That seemed unreasonable. Mr. Stefansson, being himself unable to understand the basis for Jenness's statement, wrote Mr. Desbarats submitting with his letter a copy of the Jenness article from SCIENCE. Mr. Desbarats' reply to Mr. Stefansson we are permitted to quote. It is as follows:

Deputy Minister's Office
Ottawa

1st August, 1922.

I am in receipt of your letter of the 29th enclosing a clipping from SCIENCE which contains a letter from Mr. Jenness regarding your book, "The Friendly Arctic."

On reading the quotation from the official orders beginning at the foot of page 9, I was extremely surprised at the idea of my having written anything of the kind. On comparing the quotation with the text of the instructions I find, however, that the quotation is correct, *only it is made up of three different paragraphs which in the original are separated by pages of instructions. The sentences quoted, when gathered together, as they are in Jenness's letter, give a different impression to that which they were intended to convey, or did convey when read together with the rest of the instructions.*

There can be no doubt of the government's intention to appoint you in command of the Canadian Arctic Expedition. The order in council authorizing the expedition states "Mr. Stefansson to have full responsibility, and to have the choice of the men going on the expedition and of the ship, provisions and outfit needed for the trip."

The instructions which I issued to you and from which Mr. Jenness takes his quotations are equally clear. They state, "The expedition will be under your personal direction and control, and you will give general directions to the various leaders of parties, as may be required."

The instructions which I sent out were always addressed to you. Instructions to Dr. Anderson were given to him only in your absence on your long exploring trip.

(*Signed*) G. J. DESBARATS,
Deputy Minister of Naval Service

Disobedience of orders on a polar expedition is as serious a thing as disobedience in time of war. In both cases men's very lives depend on

the loyalty and discipline of their companions. It is easily understood, therefore, that those who disobeyed will leave no stone unturned in attempting justification or extenuation. It is difficult to see, however, why they keep nagging until they drive into breaking silence us who know disagreeable things about them which Stefansson has left untold. But they at least have courage—to write from Ottawa misquotations of Ottawa officials and to assert (in the face of a vote of thanks from the Canadian nation and the endorsement of two prime ministers) that Stefansson did not have the support and does not now command the confidence of the Canadian government.

Of course the two premiers named are no longer in office and a new government has taken their place. Thinking, apparently, they might have better success with the new officials the Anderson-Jenness faction of the expedition lodged with the Minister of Mines in March, 1922, certain charges against Stefansson. These were dismissed by the minister, showing that the attitude of the present government does not differ from that of the preceding.

There remain to be mentioned Mr. Jenness's insinuations that Dr. Pearl is ignorant of Arctic conditions. Mr. Jenness can hardly say the same of us (Noice, at least, has been in the Arctic six years against three for Mr. Jenness). It is curious, then, that we find ourselves so uniformly in agreement with Dr. Pearl. Of course, Mr. Jenness may explain this by our well-known loyalty to Stefansson and our support of him and his views. But we can similarly explain the Jenness attack by his well-known affiliation with the men who in 1914 disobeyed Stefansson's orders on the ground that his views were so wrong and his plans so "unsound" that he was practically "crazy," and that they were therefore "justified" in their disobedience.

Now that the views they then thought crazy have been tested and found sound, now that the methods so bitterly criticized have been proved successful, would it not be better both for those who supported Stefansson and those who opposed him to stop squabbling and turn to more constructive things?

BURT M. MCCONNELL
HAROLD NOICE

NATIONAL RESEARCH FELLOWSHIPS IN THE BIOLOGICAL SCIENCES

To the series of research fellowships in physics, chemistry and medicine now being maintained by the National Research Council, with the financial support of the Rockefeller Foundation and the General Education Board, a new series in the biological sciences has just been added. This new series is made possible by a gift of $325,000 from the Rockefeller Foundation to be expended during the five-year period, July 1, 1923-June 30, 1928. This makes a total sum of $1,325,000 to be used by the council in the maintenance of post-doctorate research fellowships in the various scientific fields already noted.

The new series of fellowships in the biological sciences (including zoology, botany, anthropology and psychology) will be awarded to persons who have demonstrated a high order of ability, for the purpose of enabling them to continue research at suitable institutions, preferably in the United States. The personnel, equipment and presumptive cooperation of institutions will be considered in determining the residence of the fellows.

Purposes. The purpose of the National Research Fellowships in the Biological Sciences is the promotion of fundamental research in these subjects. This involves not only the immediate acquisition of more knowledge through research, but also the securing of a greater number of thoroughly trained investigators. It is hoped that the establishment of such fellowships may prevent the loss of research interest in the early post-doctorate years by the premature or excessive absorption of promising investigators in teaching, and may also improve the conditions for research in the educational and other scientific institutions of this country.

The term educational or scientific institutions, as herein used, is not to be interpreted as referring exclusively to colleges, universities and technical schools, but may include such institutions as marine or fresh-water stations, museums, government bureaus or special research institutes.

Stipends. Fellowship stipends are not in-

tended to compete with the salaries of teaching and industrial positions. They are calculated to provide comfortable living conditions for exceptional research students. They will be adjusted to family responsibilities, individual circumstances and needs. The basic stipend for first appointments will be $1,800. Appointments of fellows are for twelve months and may be made at any time but usually so as to coincide with the beginning of the academic year.

Fellowship Regulations. Fellows are expected to devote their entire time to research, except that during the college year they may, by written permission of the board, give a portion of their time, in general not more than one fifth (outside preparation included), to teaching of educational value to themselves, or to attendance on advanced courses of study. They may associate graduate students with their researches. They shall not engage in work for remuneration during the term of their appointment.

Fellows are expected to submit to the board shortly before March 1 of each year a detailed report, in duplicate, on the progress of their work. They must also present an account of their research in form as for publication before termination of the fellowship. It is understood that all results of investigation by the fellows shall be made available to the public without restriction.

The publications by a fellow of the results of the investigations carried on during the tenure of his fellowship must include a suitable acknowledgment. When such publications appear the author is expected to furnish twelve copies of each paper to the secretary of the board of fellowships in the biological sciences, National Research Council, Washington, D. C.

Appointments are subject to the condition that when a fellowship has been accepted by the applicant, it will not be vacated within the year without consent of the board.

Applications. Each application for a research fellowship in the biological sciences will be considered individually on its merits. Especial attention will be given to the probability of meeting the purposes for which the fellowships were established.

Fellows will be appointed for one year, but they may be reappointed at increased stipends.

Applications must supply evidence of their research capacity, training and intentions. This will usually include the following items:

1. A doctor's thesis or its equivalent.
2. Reports of other research work in printed or manuscript form.
3. (*a*) Academic and personal record; (*b*) an outline of the proposed research program, including the institution at which it is planned to work. These items should be presented on blanks which are provided by the secretary of the board.

In addition to the foregoing, endorsements of responsible scientists, including estimates of the applicant's qualifications, will be required. These communications should be sent directly by the writers to the secretary of the board of fellowships in the biological sciences, National Research Council, Washington, D. C.

Cooperation of Institutions. It is anticipated that institutions at which fellows are received will waive fees and will extend the usual facilities and services accorded other research workers.

Administration. The special funds for National Research Fellowships in the Biological Sciences will be administered by a board appointed by the National Research Council. The board, as at present constituted, consists of the following persons:

Frank R. Lillie (chairman), professor of zoology, University of Chicago, and chairman, Division of Biology and Agriculture, National Research Council; H. H. Bartlett, professor of botany, University of Michigan; Raymond Dodge, professor of psychology, Wesleyan University, and chairman, Division of Anthropology and Psychology, National Research Council; C. E. McClung, professor of zoology, University of Pennsylvania; T. H. Morgan, professor of experimental biology, Columbia University; W. J. V. Osterhout, professor of botany, Harvard University; C. E. Seashore, professor of psychology, University of Iowa; E. L. Thorndike, professor of educational psychology, Teachers College, Columbia University; and Clark Wissler, curator of anthropology, American Museum of Natural History.

The board is now ready to receive applications for these fellowships. All communications should be addressed to the Secretary, Board of Fellowships in the Biological Sciences, National Research Council, Washington, D. C.

VERNON KELLOGG,
Permanent Secretary, N. R. C.
WASHINGTON, D. C.

SCIENTIFIC EVENTS

POPULATION OF THE UNITED STATES

THE population of the continental United States on January 1, 1923, was approximately 110,100,000, according to an estimate announced by the National Bureau of Economic Research. This showed an estimated gain of 4,500,000 since the 1920 government census.

These figures are necessarily preliminary, said the bureau, for the final census figures on births and deaths are incomplete after the end of 1920. Enough data is available, however, to show that since January 1, 1921, the rate of increase in population has been accelerated noticeably, the present rate approaching that of pre-war years.

This more rapid gain in population has been brought about partly by increase in net migration, but has been decidedly reinforced by a reduction in the death rate. At the present rate of growth the population at the 1930 census will reach 120,000,000.

The estimates by half years are as follows:

Year and Date:	Population
1920—January 1	*105,710,620
1920—July 1	†106,381,000
1921—January 1	†106,821,000
1921—July 1	‡107,785,000
1922—January 1	‡108,533,000
1922—July 1	‡109,184,000
1923—January 1	‡110,100,000

*Census figures.
†Final estimate by this bureau.
‡Preliminary estimate.

It is probable that the revisions to be made in all estimates, except that for January 1, 1923, will be relatively slight.

The census bureau has made its estimates of the population for the intercensal years on the assumption that the rate of growth is the same as in the preceding decade. This process, which is termed a straight line extrapolation, has mainly its simplicity to commend it, for, when applied, errors of considerable size gradually accumulate as changing conditions affect population growth. For example, the official method showed a population for January 1, 1920, nearly two millions greater than that given by the actual census count on that date.

The method of the National Bureau of Economic Research is also relatively simple. The number of births and deaths have been estimated for each half year and the increase of population due to excess of births over deaths has been calculated. This amount has been corrected by adding the excess of immigration over emigration for each half year. The population for June 30, 1910, has been estimated from a smooth curve, and figures have then been built up for each half year until the census of 1920.

The estimate thus arrived at for January 1, 1920, is in error by approximately half a million, or only about one fourth of the corresponding error from the official method. The census work of the bureau has been under Dr. Willford I. King, formerly assistant professor of political economy of the University of Wisconsin.

THE FAUNTHORPE INDIAN EXPEDITION

PRESIDENT HENRY FAIRFIELD OSBORN, of the American Museum of Natural History, received on March 21 a cablegram from Mr. A. H. Vernay, of the Faunthorpe Museum Expedition to India, announcing that he had been successful in securing two exceptionally fine rhinos, a male and female, through special permission from the Maharajah of Nepal, and that the party had also secured a pair of tigers and a bear. Thus far, however, efforts to secure specimens of the pink-headed duck have failed and Mr. Vernay believes this species to be extinct, although further efforts will be made.

President Osborn states that the acquisition of the rhinos is of the first importance, not only because these animals are rapidly disappearing, but also because the Indian rhino is the largest member of that family now in existence.

Mr. Vernay's decoded message states that great difficulty was experienced in reaching the hunting grounds and that success was possible only through the assistance rendered by the

Maharajah, who provided elephants and coolies for transport and all the supplies necessary.

The Faunthorpe Indian Expedition left the United States on the first of November, 1922, accompanied by Mr. John Jonas, a taxidermist from Colorado. The party included a motion picture operator and an ornithologist. They started on their first *shikari*, or hunt, in February. Letters received from Mr. Vernay and Colonel Faunthorpe last week state that they have also secured fine representative specimens of the swamp deer, including a stag whose horns measure thirty-nine inches from tip to tip, with twelve points. The party has completed the collection of material necessary for the cheetal, nilgai and swamp deer groups, together with an excellent collection of birds. Other animals secured by the expedition are specimens of the Malabar langur. Mr. Vernay writes that these animals are very common in Bopal State where his camp was located, and added that it was with great reluctance that he shot any of these members of the monkey family, because they made no attempt at defence or attack, but that while a number of them were feeding upon the vegetation about the camp, they would post sentries from among their number who would watch for their natural enemies, the tiger and leopard, and the sentry always proved an easy target.

On March 22, it was the intention of the party to leave for Mysore to secure specimens of bison and elephants. They are sparing no efforts to obtain for the American Museum of Natural History the finest series of Indian mammals extant. All the material secured by the expedition is a gift of Colonel Faunthorpe and Mr. Vernay to the American Museum of Natural History and to the city of New York, and will form further definite bonds to cement the friendly relations now existing between England and the United States.

THE EYESIGHT CONSERVATION COUNCIL OF AMERICA

L. W. WALLACE, executive secretary of the Federated American Engineering Societies, has been reelected president of the Eyesight Conservation Council of America, which with the cooperation of engineers and educational authorities is carrying on a campaign to eliminate economic and physical losses due to poor eyesight in the schools and factories. Defective vision as a source of industrial waste was revealed by the Hoover committee on elimination of waste in industry, of which Mr. Wallace was vice-chairman. The section on conservation of vision was one of the notable features of the waste report.

Additional surveys in factories and in schools have multiplied the evidence, it is stated, that 25,000,000 gainfully employed Americans are thus afflicted. Eliminating these conditions is becoming an increasingly important problem of engineering. Associated with Mr. Wallace as members of the board of directors and of the Board of Councillors of the Eyesight Conservation Council, according to the announcement of the election of officers for the coming year, are several prominent engineers, including:

Professor Joseph W. Roe, of New York University, president of the Society of Industrial Engineers; Dr. Morton G. Lloyd, chief of the safety section of the U. S. Bureau of Standards and vice-president of the American Society of Safety Engineers; G. E. Sanford, of West Lynn, Massachusetts, past-president of the American Society of Safety Engineers.

Professor F. C. Caldwell, of the department of electrical engineering, Ohio State University, who with Secretary of Labor James J. Davis is a recent addition to the governing bodies of the Eyesight Conservation Council, is engaged in important studies in illumination bearing upon the question of eye conservation. Engineering methods will be employed by the council in surveys which are to be conducted in schools and workshops. Guy A. Henry, of New York, has been reelected general director of the council and will actively direct the eye campaign from the council's national headquarters in New York City.

Officially associated with these engineers in the movement are prominent educators, among them Dr. Sidney E. Mezes, president of the College of the City of New York; Dr. Thomas D. Wood, Teachers College, Columbia University; Dr. John J. Tigert, U. S. Commissioner of Education; Dr. Charles H. Judd, director of the School of Education of the University of Chicago; Dr. Arthur L. Day, Washington, director of the geophysical laboratories of the Carnegie Institution; Dr. Allan J. McLaughlin,

Washington, U. S. Public Health Service; Dr. W. S. Rankin, Raleigh, state health officer of North Carolina; Bailey B. Burritt, New York City, general director of the New York Association for Improving the Condition of the Poor; R. M. Little, Albany, director of the Bureau of Rehabilitation of the New York State Department of Education.

Individual industries, as a result of the publication of the waste report, are adopting eye conservation methods to promote efficiency among the workers.

CHARLESTON MEETING OF THE AMERICAN ASSOCIATION OF MUSEUMS

THE American Association of Museums is to hold its eighteenth annual meeting in Charleston, South Carolina, April 4 to 6, on the occasion of the one hundred and fiftieth anniversary of the founding of the first museum in America. Not alone is this meeting unique in that it marks an event of special interest, but also it is important through the fact that a campaign for the launching of a new nation-wide museum movement will be announced at that time.

The institution whose one hundred fiftieth year of service is to be honored is the Charleston Museum founded in 1773. It was established by the Charles-Town Library Society, and after passing through the hands of the Library and Philosophical Society and of the State Medical College it was lodged in 1850 in the building of the College of Charleston under what was probably the first contract by which a museum received municipal subvention. The Charleston museum was incorporated in 1915 and now occupies its own building. The present director is Miss Laura M. Bragg.

The new museum movement, which is to make its first public appearance at Charleston, is the culmination of an effort which has extended over a number of years and which now seems about to come to fruition. A grant of $30,000 has been made to the association by one of the large educational foundations, contingent upon the raising of an additional $55,000. There is every indication that the necessary funds will shortly be in hand and it is expected that by autumn the first attempts will be made to solve some of the general problems which American museums face to-day.

An ambitious program has been drawn up for this new work, and it will be discussed and elaborated at the Charleston meeting. Of course, only a few of the more important projects will be undertaken during the next year or two, but the plan looks well into the future. The funds now being raised will serve as a nucleus of support for three years and by the end of that time it is believed that provisions will have been made for continuance of the work.

The business of the forthcoming Charleston meeting is not its only attraction, for the gathering will be royally entertained. Each afternoon during the three days of sessions is to be devoted to seeing Charleston and to becoming better acquainted with Charleston people. The first evening there will be a series of informal receptions in the old homes and the meeting will be followed by a week-end house-party on the South Santee River. From headquarters at the Santee Gun Club and The Wedge and Harietta plantations, trips will be made into the heron reserves and along the rice field canals.

LAURENCE VAIL COLEMAN
Secretary

COLLOID CHEMISTRY SYMPOSIUM

PRELIMINARY announcements concerning the National Symposium on Colloid Chemistry, to be held at the University of Wisconsin June 12th to 15th inclusive, have already appeared in these columns. Inasmuch as this is the first national symposium on this subject to be held in America, it is desired that the whole field be represented, as far as possible, and the program has been arranged with that end in view. With one or two exceptions the papers will be presented in person by the author and ample time will be afforded for discussions. The papers and discussions will be published in monograph form, according to present plans.

It is hoped that the chemists and others interested in colloids will avail themselves not only of the opportunity to hear the papers presented, but to get acquainted with others in this most interesting and rapidly developing field of science, as well.

It is expected that accommodations for all visitors can be secured at the University Club or the University Y. M. C. A., both of which are near the lake and adjoining the campus.

Following the Symposium Professor Svedberg will give a series of about thirty lectures on colloid chemistry in the summer school, which commences June 25th and closes August 4th. Research work will be continued under his direction during this period.

The final program will appear about June 1st.

For further information letters should be addressed to Professor J. H. Mathews, Chemistry Department, University of Wisconsin, Madison.

The tentative program for the symposium follows:

Alexander, J. "The Colloidal state in metals and alloys."

Bancroft, W. D. "Precipitation of sols by alcohol."

Bartell, F. E. "Some adsorption studies."

Bogue, R. H. "Conditions affecting the hydrolysis of collagen to gelatin."

Browne, F. L. "Thermochemistry of sulfur sols."

Burton, E. F. "General considerations of the forces determining the limiting size of the colloidal particle in any given solution."

Fischer, Martin. "On the theory of the lyophilic colloids."

Gortner, R. A. "The application of colloid chemistry to agricultural problems."

Holmes, H. N. "Gel formation."

Kahlenberg, L. "On the precipitation of colloidal metals by means of metals in the solid state."

Klein, D. "The colloid chemical problems in the manufacture of enzymic and animal glandular products."

Mathews, J. H., and *Rowland B. W.* "The thermochemistry of protein behavior."

Sheppard, S. E. "Dispersity of silver halides in relation to their photographic behavior."

Spear, E. B. "Colloidal properties of rubber and compound ingredients."

Svedberg, The. "Demonstrations of colloid chemistry technique."

Taylor, H. S. "The problem of adsorption from the standpoint of catalysis."

Weiser, H. B. "The formation of inorganic jellies."

Wilson, John A. "The swelling of protein jellies."

Wilson, Robert E. "Surface films as plastic solids."

Papers are expected from T. R. Briggs, C. W. J. Frazer, Jacques Loeb and W. A. Patrick.

SCIENTIFIC NOTES AND NEWS

THE spring meeting of the American Chemical Society opens at New Haven on April 2, under the presidency of Professor E. C. Franklin, of Stanford University.

AT the annual meeting of the National Academy of Sciences, to be held in the United States National Museum, Washington, D. C., from April 23 to 25, Dr. W. W. Campbell, president of the University of California and director of the Lick Observatory, will give on the evening of April 23 an address on "Results obtained by the Crocker Expeditions from Lick Observatory."

ANNOUNCEMENT is made of a course of two illustrated evening lectures, to be held in the Administration Building of the Carnegie Institution of Washington, Washington, D. C., relative to investigations which are now being carried forward by research associates of the institution, as follows: April 19, Dr. R. A. Millikan, of the California Institute of Technology, on "Present problems in the field of atomic structure and their bearing upon the nature of ethereal radiations"; April 25, Dr. A. A. Michelson, of the University of Chicago, on "Application of interference methods to astronomical problems."

PROFESSOR CHARLES MOREU has been elected president of the Chemical Society of France.

UNDER the auspices of the Massachusetts Board of Health, the Boston Board of Health and the department of preventive medicine and hygiene of the Harvard Medical School, a dinner was given recently in honor of Dr. Béla Schick of Vienna at the Hotel Lenox, Boston. Dr. Francis X. Mahoney, city health commissioner of Boston, presided, and Dr. Rosenau was toastmaster. Dr. Schick was presented with a gold set of the equipment used for the Schick test by the city. It was announced that 30,000 children in Boston have been tested since May 1, 1922.

THE New York branch of the American Pharmaceutical Association has awarded the

fourth impression of the Remington Honor Medal to Dean Henry Hurd Rusby of the College of Pharmacy of Columbia University, in recognition of his extensive botanical researches and especially for the discovery of a number of important drug plants in his South American explorations.

WE learn from *Nature* that on February 12 Professor Otto Pettersson, director of the Swedish Hydrographic Biological Commission, Gothenburg, celebrated the seventy-fifth anniversary of his birth. Having in early life made a European reputation as a chemist, Professor Pettersson turned his attention to the study of oceanography, and much of the work in that subject during the last thirty years has owed its success to him. His name is particularly associated with the foundation in 1902 of the International Council for the Study of the Sea, of which organization he was president for a number of years.

DR. CHARLES VAILLART, the X-ray experimenter, who lost both arms through his work, at an official reception at the Hotel de Ville, Paris, was presented with the *cravate* of the Commander of the Legion of Honor, the gold medal of the City of Paris, and an inscribed plaque awarded by the Carnegie Trust. Those present included M. Strauss, minister of hygiene; the American Ambassador, Mr. Herrick, and Madame Curie.

ACCORDING to press reports, Professor Albert Einstein, of the University of Berlin, has resigned as a member of the League of Nations commission on intellectual cooperation, on the ground that "the league has neither the strength nor the good will necessary to accomplish its task."

DR. CHRISTOPHER K. INGOLD was awarded the Meldola medal of the Institute of Chemistry at the annual meeting of the institute held on March 1.

PROFESSOR ROBERT E. COKER, of the University of North Carolina, will during the coming summer again serve as director of the biological laboratory of the Bureau of Fisheries at Wood's Hole, Massachusetts.

MR. M. R. CAMPBELL, geologist in charge of the coal section of the Geological Survey for the past sixteen years, has been relieved of this duty at his own request that he may devote himself to the physiographic work of the Survey. Mr. W. Taylor Thom, Jr., has been assigned to succeed Mr. Campbell in the coal work.

MR. C. A. BRIGGS, associate physicist, division of weights and measures, Bureau of Standards, has been transferred to the United States Department of Agriculture to the post of live stock weight supervisor in the packers and stockyards administration.

DR. FRANK APP has resigned from the staff of the Agricultural College and Experiment Station of Rutgers College to become vice-president of the Minch Brothers Company at Bridgeton, N. J.

DR. J. C. KARCHER of the sound laboratory, Bureau of Standards, has resigned to accept a position as technical adviser to the production manager of the Western Electric Company, Chicago, Illinois.

A COMMITTEE of dye chemists has been appointed by the secretary of agriculture upon recommendation of W. G. Campbell, acting chief of the Bureau of Chemistry, to formulate plans of work for the color laboratory. The committee consists of R. Norris Shreve, secretary of the Dye Division of the American Chemical Society; Willard H. Watkins of the National Aniline and Chemical Co., Buffalo; Louis A. Olney of Massachusetts, president of the American Association of Textile Chemists and Colorists; Dr. William J. Hale, of Michigan, chairman of the Dye Division of the American Chemical Society, and Dr. Clarence G. Derick of Buffalo.

MR. N. GIST GEE, for twenty years professor of biology at Soochow University, China, has been appointed adviser on premedical education to the China Medical Board of the Rockefeller Foundation. He will make a study of the teaching of chemistry, physics and biology at colleges in China.

PROFESSOR F. L. WASHBURN, of the University of Minnesota, has returned from the South Pacific with a collection of several thousand specimens of insects for that institution from the Marquesas and Society Islands. Almost all orders are represented, and sufficient material

in the various families was secured to afford opportunity for exchange with other institutions. Most of this material was secured at from 100 to 300 feet above sea level, but many specimens were also taken at elevations of 1,500, 2,500 and 2,800 feet.

PROFESSOR WILLIAM H. HAAS, associate professor of geology in Northwestern University, has returned from a 9,000-mile journey through South American countries, covering a period of nine months. Accompanied part of the time by Professor Cox, of the department of history, Professor Haas made an extensive investigation of the various mineral deposits of Peru, Bolivia, Chile, Argentina, Uruguay and Brazil.

DURING the summer vacation, Willard N. Clute, editor of *The American Botanist*, will conduct a party on a botanical exploring trip to the painted desert, Navajo Mountain and the Rainbow Bridge. The region is one practically untouched by botanists. A previous trip brought to light several new species and this year it is hoped to complete a survey of the flora.

A LEAVE of absence for two weeks has been granted by the University of Iowa to Dr. Bird T. Baldwin, director of the Child Welfare Research Station, in order that he may make a trip to Leland Stanford, Jr., University to cooperate with Dr. Lewis L. Terman in a scientific investigation of 1,000 superior children. Dr. Terman has been selecting the most gifted children in California during the past year by means of mental and educational tests. Dr. Baldwin will organize and direct the physical measurements. He will continue his research in the general problem of the relation of physical growth to mental development with this particular group of selected children. Miss Beth Wellman, research assistant in the Child Welfare Research Station, will spend three months in California making detailed physical measurements of each child. The investigation has been financed by the Commonwealth Fund of New York City.

DR. R. K. NABOURS, of the Kansas State Agricultural College, gave the presidential address before the recent meeting of the Kansas Academy of Science on "Eugenics, the limitations and the promise."

DR. JOHN HOWLAND, professor of pediatrics in the Johns Hopkins University, will deliver the ninth Harvey Society lecture at the New York Academy of Medicine on Saturday evening, March 31. His subject will be "Rickets."

DR. WILLIAM DILLER MATTHEW, curator of vertebrate animals in the American Museum of Natural History, gave a public lecture on March 5, at the University of Michigan, on "Evolution and the dispersion of the dinosaurs." He also gave two other lectures of a more technical nature on the general topic, "The evolution and dispersion of Tertiary animals."

THE Beaumont lectures for 1923 were delivered before the Wayne County Medical Society at Detroit, January 29-30. Dr. J. R. Macleod, professor of physiology at the University of Toronto, Canada, delivered the first two lectures on "The physiology and pathology of the pancreas and the demonstration of new discoveries of pancreatic hormones." The third lecture was delivered by Dr. F. G. Banting, of the University of Toronto, on "Clinical work on insulin."

LIEUTENANT COLONEL F. H. GARRISON, U. S. Army Medical Department Research Board, recently gave a series of six lectures on the history of medicine before the faculty and student body of the College of Medicine and Surgery of the University of the Philippines, Manila.

LEASON H. ADAMS, of the Geophysical Laboratory of the Carnegie Institution, spoke before the Chemical Society of Washington, on March 8, on "Reactions and properties of substances at high pressures."

PROFESSOR MEYERHOF, the physiologist of Kiel, has been invited to deliver a series of lectures at New York, Boston and Baltimore, and has accepted. He spoke in Cambridge last year on his research on cell respiration and muscular energetics.

ON February 13 Professor Cassius J. Keyser, of Columbia University, delivered an address on "Humanity and education" at a joint meeting of the High School Men's Club and the High School Women's Club of Jersey City; on February 27 he spoke on the same subject at a joint meeting of the faculty and

senior class of the Packer Collegiate Institute. At a meeting, March 10, of the Association of Chairmen of the Departments of Mathematics of the High Schools of New York City, Professor Keyser gave an address on "Mathematics and man."

DR. CECIL H. DESCH, professor and dean of the faculty of metallurgy in the University of Sheffield, delivered recently the "Second Sorby Lecture" on "The services of Henry Clifton Sorby to metallurgy." The Sorby lectureship has been instituted by Sheffield engineering associations to commemorate the work of Dr. Sorby, who rendered signal service to metallurgy and to microscopy.

THE committee in the Netherlands has collected and presented to Professors Borrel and Weiss at Strasbourg the sum of 10,000 francs toward the monument to Louis Pasteur in the city in which he began his scientific career. The Pasteur Institute of Paris and the descendants of Pasteur will present to the council of the League of Nations a bust of Pasteur, in gratitude for the appointment of a member of the council and a delegation from the health committee of the League of Nations to attend the centenary of Louis Pasteur at Strasbourg.

THE bicentenary of the death of Sir Christopher Wren was observed in London, February 25-March 3. The ceremonies were organized by the Sir Christopher Wren Bicentenary Grand Committee, consisting of representatives of thirty-eight scientific and municipal bodies. Sir Christopher Wren was president of the Royal Society from 1680 to 1682. A memorial volume of essays on various aspects of his life and work has been published, the profits being devoted to the preservation fund of St. Paul's Cathedral, of which Sir Christopher was the builder.

DR. GEORGE BRUNE SHATTUCK, the distinguished Boston physician, for more than thirty years editor of the *Boston Medical and Surgical Journal*, has died at the age of seventy-nine years.

THE death is announced of Clarence Erskine Kelley, instructor in astronomy at Harvard University.

GUSTAVUS DETLEF HINRICHS, formerly professor of physical science at the State University of Iowa, and of chemistry at the St. Louis College of Pharmacy, has died at the age of seventy-seven years.

PROFESSOR W. N. PARKER, emeritus professor of zoology at the University College of South Wales and Monmouthshire, Cardiff, died on February 22, aged sixty-five years.

DR. TERANO, director of the Aeronautical Research Institute in connection with the University of Tokyo, died on January 8, aged fifty-four years.

AS has already been reported in SCIENCE in 1920, a committee was formed to commemorate Sir Victor Horsley's services to science. It may be remembered that he died while on service with the army in Mesopotamia, in 1916. The *Journal* of the American Medical Association reports that subscriptions amounting to $5,000 were received from all over the world. The committee, over which Sir Charles Ballance presides, and of which Sir Frederick Mott is treasurer, resolved that the money should be invested in the name of a board of trustees, who should triennially appoint some one to deliver a lecture in London under the title of the Victor Horsley Memorial Lecture. No limitation is placed as to the country or profession from which the lecturer shall be appointed, or as to the subject of the lecture. Sir Edward Sharpey Schafer, professor of physiology in the University of Edinburgh, has accepted the invitation of the trustees to deliver the first lecture, which will probably be given in the autumn.

THE late A. Crum Brown, professor emeritus of chemistry in the University of Edinburgh, bequeathed to the Royal Society of Edinburgh his portrait, painted by Mr. E. A. Walton, presented to him by friends and former pupils. He made provision also for handing over his collection of portraits of scientific men to the department of chemistry of the University of Edinburgh.

THE Baird Ornithological Club of Washington, D. C., held its annual meeting at the Cosmos Club on March 14, 1923. The incumbent officers were re-elected and are as follows: *President,* Dr. A. K. Fisher; *vice president,* Mr. Ned Hollister; *secretary,* Mr. B. H. Swales. A council was formed to consist of the officers

and two additional members to which Drs. C. W. Richmond and T. S. Palmer were elected. During the year the club held its regular monthly meetings generally at the home of some one of the members. The meeting of February 20, 1923, was a memorial to celebrate the one-hundredth anniversary of the birth of Professor Spencer Fullerton Baird with special reference to his career as an ornithologist. Drs. W. H. Dall, C. Hart Merriam and Leonhard Stejneger gave reminiscences of their relations with Professor Baird and the latter's standing as a naturalist and administrator.

THE American Geophysical Union will hold its annual meeting at the Carnegie Institution of Washington from April 17 to 19, 1923. The first day will be devoted to general addresses respecting the organization and aims of the International Research Council, the United States National Research Council and the American Geophysical Union, followed by special addresses outlining the status and scope of the problems receiving the attention of the several sections of the union. The second day and the morning of the third day will be devoted chiefly to meetings of the respective sections, at which reports of investigational committees and scientific papers will be presented. The union will close its annual meeting with a business session on Thursday afternoon, April 19. (For the present organization of the union, see SCIENCE, March 24, 1922, pp. 311-312).

THE director of the United States Coast and Geodetic Survey announces that Congress, at its recent session, made an appropriation of $2,000 to the State Department for the support of the International Latitude Observatory at Ukiah, California, during the fiscal year 1924, or until some other provision is made for that station. In the estimates for the Coast and Geodetic Survey for the fiscal year 1924 there was included an item which, if it had been approved by Congress, would have authorized that bureau to carry on the variation of latitude observations at Ukiah as a part of its regular geodetic work. It is hoped that this authority will be granted during the next session of Congress in order that there may be no possibility of a break in the observations for variation of latitude which have been made continuously at Ukiah for the last twenty-three years.

THE Senate committee on Reforestation, headed by Senator McNary, of Oregon, left Washington March 18 for the purpose of making investigations in the south. It will conduct hearings and investigations in Florida, Mississippi and Louisiana, going as far as New Orleans. It will return to Washington about April 1 and resume investigations and hold sessions this summer throughout the West and Northwest and in New England.

PRESIDENT HARDING, by proclamation, has designated the week of April 22 to 28 as "Save-the-Forests Week." Urging governors of the states to do likewise, the President calls attention to the importance of forest preservation to the industrial and commercial life of the nation and to individual welfare, and points out that fires, which are the result of carelessness or thoughtlessness, do great damage, threatening the timber supply and endangering the cover of watersheds of streams that are used for navigation and irrigation.

THE annual congress of the Royal Institute of Public Health will be held in Scarborough, England, from May 16 to 21, under the presidency of Lord Riddell.

IT is announced that at a meeting in London on February 15, the National Sea Fisheries Protection Association was formally wound up and a new association, called the Association of British Fisheries, was constituted. This, it is understood, will be recognized by the government as representing every branch of the fishing industry.

A BILL now before the Connecticut legislature, entitled "An act for the establishment of a psychiatric hospital," calls for an expenditure of $250,000 for the establishment of the hospital, and an annual appropriation for maintenance on the part of the state. Yale University will provide the site for the hospital, funds for the support of the medical staff and for investigations into the cause, nature and prevention of mental disease. The bill was the result of an investigation by the state psychopathic commission, which reported the need of such an institution and recommended its location in New Haven in conjunction with the school of medicine.

THE cornerstone of the Gorgas Institute of

Tropical Medicine at Panama was laid on February 1 by President Porras, assisted by members of the American College of Surgeons touring in South America. The institute will be governed by a board of directors of which Rear Admiral W. C. Braisted, retired, is president and Dr. Richard P. Strong, director of the Harvard University School of Tropical Medicine, is the scientific director.

UNIVERSITY AND EDUCATIONAL NOTES

MR. JOHN HAYS HAMMOND has endowed a scholarship in engineering for a Mexican student at Yale University. The scholarship is for a four years' course and covers expenses of tuition, dormitory, meals, books, fees, etc., and transportation from and to the Mexican border.

DR. GEORGE E. POTTER has endowed a fellowship in pathology in the Detroit College of Medicine and Surgery.

THE new chemistry section of the Technical High School of Stockholm has been opened. The building, which cost 3,300,000 kroner, is said to be one of the largest chemical laboratories of the world. It has four large laboratories for inorganic, organic, technical and electro-chemistry, and a smaller for the study of fermentation. The director is Professor W. Palmaer.

MISS ADA LOUISE COMSTOCK, dean of Smith College, has been appointed president of Radcliffe College, in succession to Dr. Le Baron R. Briggs, who for twenty years has been head of Radcliffe and dean of the faculty of arts and sciences at Harvard University.

DR. IRA N. HOLLIS, for ten years president of Worcester Polytechnic Institute, and previously professor of engineering at Harvard University, has offered his resignation to the board of trustees.

DR. ARTHUR HOLLY COMPTON, head of the Department of Physics in Washington University, has been appointed professor of physics at the University of Chicago.

PROFESSOR STRAUB of Freiburg has been called to Munich to occupy the chair of pharmacology as successor to Professor von Tappeiner, who is to retire on account of his advanced age.

DISCUSSION AND CORRESPONDENCE

AN UNUSUAL OCCURRENCE OF ROCK BORING MOLLUSKS IN CONCRETE ON THE PACIFIC COAST

IT has often been supposed that concrete in sea water might be subject to attack by rock boring mollusks, especially of the family Pholadidæ, various species of which perforate rocks of a number of different kinds and often of a considerable degree of hardness. But specific instances of the occurrence of these organisms in concrete marine structures have been lacking. Hence the data here reported are of considerable interest from both the biological and engineering points of view.

In the work of widening the channel in Los Angeles harbor, about November 13, 1922, it became necessary to remove some old wooden piling which had been protected from marine borer attack by jacketing with concrete. It was discovered by Mr. D. E. Hughes, engineer in charge of dredging operations, that, of 18 such jackets examined at this location, 16 had been more or less attacked by pholad borers. About five were considered to be badly attacked, containing six or more borers per square foot of exposed surface; the others contained fewer, and some only an occasional borer. The two jackets not attacked stood in shallower water than the others. The jackets had been in place fourteen years, but had not been exposed to rock borer attack during the entire period, as the form lumber had been left about the jackets when they were constructed, and this gave protection from the rock borers until the wood was destroyed by wood boring organisms. In some cases, indeed, a thin shell of the old form lumber still remained adhering to the concrete.

Attention of the writers was called to this finding, and, with the cooperation of the Los Angeles Harbor Engineering Department and the San Francisco Bay Marine Piling Committee, collaborating with the National Research Council committee on marine piling investigations, a further investigation was made. It was found that, of concrete jacketed piles at four different locations in Los Angeles harbor, in fact, at every point in the inner harbor where such piles exist, about 50 per cent. had been more or less attacked, of which rather

more than one fifth were very considerably bored. Of those not attacked, a number stood so far inshore as to be but little exposed to the action of the borers.

These jackets were in general of a less than average grade of cement mortar, from 2 to 5 inches in thickness, some being decidedly poor, others fairly hard, as indicated by the fact that some of the jackets had given service in sea water over a period of fourteen years. Samples of the best mortar in which borers were found showed an air penetration of 1/16 inch in seven weeks when tested with phenolphthalein. Mr. A. A. M. Russell, testing engineer to the California State Harbor Board, has very kindly made a crushing test of a sample of one of these jackets, finding the crushing strength of a specimen 2½"x3½", 4" high, to be 1,726 pounds per square inch. Mr. Russell reports the grading of the aggregate to be as follows:

Screen	*Percentage*
10- 20	1.78
20- 30	.89
30- 50	4.46
50- 80	51.78
80-100	16.07
100-200	16.07
Pass 200	8.94

The species occasioning most of the damage here was found to be *Pholadidea penita* Conrad, a borer which occurs in suitable habitats from Alaska to Lower California, and possibly even to Ecuador.[1] Specimens taken from these pile jackets averaged about 4 cm. in length, with a maximum length of 7 cm. and a maximum diameter of burrow of 3.2 cm. In some cases the borers had gone entirely through the jackets until in contact with the wood within, but none had continued boring into the wood.

The nestler *Petricola carditoides* Conrad was found somewhat commonly in these jackets, but presumably only in old pholad burrows. *Platyodon cancellata* Conrad was also found sparsely, in badly disintegrated concrete.

The wide distribution of *Pholadidea penita* suggests possibilities of attack on concrete marine structures in other Pacific Coast harbors. Indeed, reports of such action by this or a similar borer at such widely separated points as Anchorage, Alaska, and Panama, have recently come to hand.

In jacketing piles, it has often occurred that the concrete has been "drowned," either by the presence of too much water in the mix, or by depositing the material in water, causing segregation and laitance, and rendering such structures especially liable to borer action. The probabilities of attack on well made precast piles and other high grade concrete structures hinge upon whether the action of the borers is mechanical or chemical, or both. If it be predominantly chemical, density of the material will probably serve only to make the boring slower. It appears, at any rate, that the use of concrete for marine construction is not as yet a final solution to the marine borer problem, at least in localities where rock boring mollusks occur.

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[1] Dall, W. H.: Proc. U. S. Natl. Museum, *37*, 276. 1910.

AN INTERESTING LIVERWORT

A SHORT time ago, one of my students, Mr. T. Domoto, brought to the laboratory a peculiar liverwort which at first I had some difficulty in identifying. The specimens were collected in a nursery in Oakland, owned by his father.

A further investigation of the plant showed that it was undoubtedly the curious *Monoselenium tenerum*, Griffith, described in detail by Goebel[1] about a dozen years ago. So far as I know, the plant has not been reported since that time.

Goebel's specimens were found growing in earth sent from Canton to Munich with specimens of tea plants. The liverworts were first noticed some time after the arrival of the material in Munich.

Goebel decided that the plant was Monoselenium, of which the only account was in the posthumous notes of Griffith.[2] No specimens are known in herbaria; but Goebel concluded from Griffith's description and figures that Griffith's *Monoselenium tenerum* from India was the same as the Canton plant.

Monoselenium closely resembles a small Du-

[1] Flora, 101: 43-97. 1910.

[2] Posthumous papers. Part II (1849)—Notulæ ad Plantas Asiaticas, p. 34.

mortiera, and in spite of certain differences which Goebel points out, I am inclined to believe that the two genera are pretty closely related. In Monoselenium there is a marked degeneration of the sporophyte, the elaters being quite rudimentary. Spores and elaters of the Oakland specimens agree exactly with Goebel's figures.

There can be no doubt that the Californian specimens have been introduced with nursery stock from China or Japan, and a careful search in those countries would probably show that the plant is not an exceptionally rare one.

DOUGLAS HOUGHTON CAMPBELL
STANFORD UNIVERSITY

COAL BALLS

I AM anxious to obtain information on American coal balls, such as have been found mostly, up to now, in the coal seams of England and northern France, and which were used by J. Lomax in Bolton, England, for his magnificent thin sections of paleozoic plants. The coal balls have not been reported anywhere in North American coal seams, but they exist here. A splendid specimen of such a coal ball was obtained by the Illinois State Geological Survey at Harrisburg, Illinois, O'Gara Mine No. 9, and others were collected by myself in coal seam No. 5 in Illinois and coal seam No. 9 in Kentucky. Recently a coal ball from Newcastle, Texas, was sent to me by W. E. Wrather. These so-called coal balls are well preserved and petrified plant tissues which appear in brown or black lumps in upper portions of coal seams. Their preservation is due there to penetration by silica or calcium carbonate. They allow microscopic examination of the most minute details. I think some of the bone coal, called so by miners, and quoted occasionally in literature, may be coal balls.

It would be extremely gratifying if a sufficiently large number of American coal balls would be discovered to increase materially our knowledge of carboniferous plant morphology which is now exclusively based on English and French material. I shall be very glad to receive any communications from coal operators or state surveys which may lead to the discovery of deposits of coal balls.

A. C. NOÉ
UNIVERSITY OF CHICAGO

A FUND FOR GERMAN AND AUSTRIAN LABORATORIES RAISED BY THOSE WHO HAVE WORKED IN THEM

"We should rather through the instrumentality of men of science soften the asperities of national hostility."—Humphry Davy to a delegation from the French Academy which went to London in 1807 while war was in progress between England and France.

The desperate financial condition of the German and Austrian laboratories is well known. If any one desires to help a specified laboratory or a specified head of a laboratory, any contribution given will be sent as from the donor directly to the individual in charge of such laboratory.

The following individuals were the first to subscribe to this fund, which already reaches $2,175:

Abel, J. J.; Baldwin, E. R.; Carlson, A. J.; Chittenden, R. H.; Conner, L. A.; Cushing, H.; Dakin, H. D.; Farnam, H. W.; Greenwald, I.; Hatcher, R. A.; Howland, J.; Kerr, A. T.; Kingsbury, B. J.; Lee, F. S.; Lilienthal, H.; Lusk, G.; Marine, D.; Means, J. H.; Meigs, E. B.; Mendel, L. B.; Niles, W. L.; Palmer, Mrs. W. W.; Peabody, F. W.; Pierce, H. F.; Pike, F. H.; Pratt, J. H.; Pritchett, H. S.; Ringer, A. I.; Robinson, C.; Scott, E. L.; Shaffer, P. A.; Simpson, S.; Sollman, T.; Stern, Miss F.; Talbot, F. B.; Tiffany, Mrs. C. L.; Wallace, G. B.; Wilder, R. M.; Woodyatt, R. T.

Checks of $5 to $150 have been received: any sum will be welcomed.

Make checks payable to Graham Lusk, *Treasurer,* 477 First Avenue, New York City. The fund will be closed on May first.

GRAHAM LUSK
CORNELL MEDICAL SCHOOL

QUOTATIONS

SCIENCE AND THE PACIFIC

ON the invitation of the Commonwealth Government, which has promised the sum of £5,000 towards the cost, a Pan-Pacific Congress is to be held in Melbourne and Sydney in August and September of this year. The National Research Council of Australia has arranged an extensive program and invitations are being issued to the scientific men of countries bordering on, or having interests in, the Pacific. The Pacific Ocean is a geographical and biological unit, and many problems of

scientific and practical interest can best be solved by the cooperation of people with local knowledge—if, indeed, the word "local" can be applied to so large a part of the surface of the globe. The first Pan-Pacific Congress was held at Honolulu in 1920, on the initiation of the National Research Council of the United States, which issued the invitations and arranged the program. In commenting at the time on this striking evidence of the growing importance of the Pacific in the economy of the world and of the shifting of the center of gravity of American interests from the Atlantic seaboard, we remarked that the world was round, and that the congress at Honolulu would reach problems which the British Empire approaches from the other side.

We are the more glad to record the important step taken by Australia and to offer our best wishes for the success of the meeting this year. Although the United States and Canada, Australia, New Zealand, China and Japan have the more immediate interest in the science of the Pacific, there is no geographical limit to the advantages gained from the acquisition of knowledge. Not long ago it was thought, for example, that meteorology of the northern hemisphere could be investigated sufficiently without reference to what takes place south of the equator. But the world is an organic whole, and the storm centers, currents of the air and of the oceans, even the vibrations of the solid earth, have a general effect. The geology, the animals and plants, the races and the habits of men in any one part of the world must be understood if we are to advance in our knowledge of any other part of the world to comprehend the past, to adapt ourselves to the present and to make reasonable anticipations of the future. It is to be hoped that the leading scientific bodies in this country will send delegates to the Pan-Pacific Congress in Australia.—*The London Times.*

SCIENTIFIC BOOKS

THREE OF A KIND

Handbook of Meteorology, A Manual for Cooperative Observers and Students. By JACQUES W. REDWAY. John Wiley and Sons, 1921. 294 pp. Price $4.00.

The New Air World, The Science of Meteorology Simplified. By WILLIS LUTHER MOORE. Little, Brown and Company, 1922. viii + 326 pp. Price $3.00.

Climatic Changes, Their Nature and Causes. By ELLSWORTH HUNTINGTON and STEVEN S. VISHER. Yale University Press, 1922. xiii + 329 pp. Price $3.50.

The above three of America's latest book contributions to meteorology have a peculiar group distinction (that is why they are reviewed *en bloc),* the distinction of running from horrid to worse in whatever order one may read them.

Mr. Redway says that his book was written "for the use of cooperative observers and for the instruction of students in meteorology and aeronautics." But no such worthy purpose can be accomplished by a book that literally has more errors and loose statements than pages, especially when many of these errors are fundamental.

A few "horrid examples," selected from a very great number, will indicate, perhaps, what radical revision this book must undergo before it can be recommended for serious use:

Page 2: "Carbon dioxide is not observable above an altitude of two or three miles." But it is "observable" at much greater altitudes, as we know from those who have made such observations, and as we are compelled to assume from the fact that vertical convection keeps the atmosphere well mixed through a depth of six or seven miles.

Page 3: Here it is stated that at the surface of the earth ozone amounts to twelve parts (whether by weight or by volume is not stated) per million of the atmosphere. Presumably the author found this statement somewhere, but at the same time he had access to the results of those modern observations that have shown that the lower atmosphere contains no more than bare traces of ozone.

Page 6: "Strictly speaking, it is the vapor itself and not the space, nor the air, which is saturated." Obviously, the author got the idea in some way that it is not scientifically exact—and it is not—to say that the air is saturated, and then deliberately made a worse statement.

Page 12: The various statements on this page, largely mere jumbles of words, are good

examples of the way one is likely to write about force, heat, energy and power, when he has no clear conception of any of them.

Page 14: "If a given volume of gas—say a cubic foot of oxygen—be introduced within a container, its pressure or tension noted, the same volume of another gas having the same tension may be introduced without an increase of tension of the mixture." This deals with a fundamental property of gases, and is as wrong as it would be possible to make it. It is not a slip, either, for it is stressed by an example, wrong, of course.

Page 16: "as they [non-visible radiations] fall on the body, they produce the sensation of warmth, thereby stimulating the growth of living matter." Perhaps it might be a good exercise to grope one's way through this mental fog.

Pages 21-22: The "solar constant" is discussed on these pages, but in a sense (just what sense is not clear) entirely different from that of the authors cited.

Page 23: " . . . heat radiated from the earth's interior to the surface." What, indeed, does the author mean by "radiated?"

Page 41: "In centigrade terms, the increment is 0.00037 for each degree, measured from the absolute zero." This does not confuse, however much it may irritate, any one who knows that for "increment" he should say "coefficient of expansion"; that 0.00037 is one tenth the proper value; and that for "absolute zero" he should substitute "freezing point." But think of the predicament of the reader of this book who does not know these things!

Page 54: "This [condensation] liberates a great deal of latent heat, materially warming the air." But the air is not warmed by the setting free of latent heat. The upper portion of a cloud is always colder than its lower surface however much the condensation, and however great the liberation of latent heat.

Page 73: "One can not say why cloud matter floats in the air, apparently contrary to the laws of gravity." If he can not, and wants to know, why not ask the first physicist he happens to meet, or, one would think, most any one else?

Page 116: "The most extraordinary effects of lightning are the dark flashes occasionally caught in photographs of lightning." This is only a peculiarity of the photographic plate and not anything extraordinary about the lightning, as the author had every opportunity to know.

Page 121: "The simple halo is practically a rainbow." This is a good example of the exceedingly numerous loose and utterly misleading statements in this book. Certainly no one who understands the halo and the rainbow would dare say that they are practically the same.

Page 122: "They [iridescent clouds] may be due to causes similar to those which produce halos, but the causes are not known." They are not so produced, and their well-known cause has been widely published.

Page 158: "Possibly the conjunction of planets may affect the movement and formation of storms." Obviously, then, the author does not really believe that an effect must have had an adequate cause.

Page 255: "The convenient unit of magnetism is one which attracts or repels an equal quantity at a distance of one centimeter." "An ampere, the practical unit of current, is the electromotive force of one volt against a resistance of one ohm."

About as accurate as the schoolboy's definition of the equator—a menagerie lion running around the earth—and typical of the whole book from start to finish.

The best feature of the book, and that a commendable one, is its considerable number of good to excellent cloud pictures. The two or three faulty legends can easily be corrected.

The author of the second of the books here under review arouses the anticipation of something exceptionally fine by signing himself "Sc.D., LL.D., Professor of Meteorology George Washington University; eighteen years Chief of the United States Weather Bureau." But this promise is not kept, for neither the mere grammar-school grade of what follows, nor its scores of errors and numerous loose and inaccurate statements, are what would naturally be expected from one having such degrees and so long occupying the most important position in America in connection with the science he professes to be elucidating.

Time and again the matter under a sub-title is only an aimless ramble that explains nothing and has but little relation to the supposed subject.

But to cite specifically a few of the many errors—to note and explain all would require a book:

Page 8: "The atmosphere is thus by absorption of radiation warmed largely from the bottom upwards, which accounts for the perpetual freezing temperatures of high mountain peaks, although they are nearer the sun than are the bases from which they rise." This, as any physicist knows, is a wholly inadequate explanation of the phenomenon in question. Absorption at the surface in excess, on the average, of radiation; and radiation by each portion of the upper air, up to eleven kilometers, roughly, above sea level, in excess, on the average, of absorption, are the necessary and sufficient causes, through the convection thus maintained, of the practically continuous state of decrease of temperature, in this lower portion of the atmosphere, with increase of height.

Page 9: "The temperature at this altitude [100 miles] must be that of outside space, probably 459° F. below zero. Air liquefies at 312° below, and therefore it can not exist in the gaseous state in a region having a lower temperature. When it liquefies it has the color and general appearance of water, and about the same specific gravity."

The expression "temperature of outside space" is a familiar string of words to which, as a rule, no particular meaning seems to be assigned, nor, literally, has it any meaning. If we agree that it shall mean the temperature to which a small "black body" would come if placed at the point in question, then by terrestrial radiation alone the temperature one hundred miles above the surface of the earth would be, roughly, —70° F., and not —459° F.

This seems to be one of the author's favorite errors, for he repeats it in one form or another in several different places.

The temperature, —312° F., below which, it is stated, air can not exist in the gaseous state, is the boiling point of liquid air *at atmospheric pressure*. Air, therefore, can exist in abundance in a gaseous state at lower temperatures. In fact, at —346° F. it (at least the nitrogen) would exist in a gaseous state at a pressure one tenth that of a full atmosphere.

The density of liquid air is only 90 per cent., approximately, that of water, instead of "about the same."

Furthermore, the color of liquid air is a pale, steel blue, a color that does not pertain to water.

Page 9: "At this distance [fifty miles] from the earth there probably is no more air than would be found under the receiver of the best air-pump, and, the reader will be surprised to learn, darkness is practically complete, although the hour may be midday, for there are no dust motes to scatter and diffuse and render visible the rays of the sun."

This is another of the author's pet errors, often repeated, and of long standing. Why reflection, or scattering, is essential to render solar rays visible, is not explained. Seemingly, the author confuses transparency, absence of haze and "good seeing" with darkness!

Page 23: "The ingenuity of the Wrights transformed the weather man's kite, strengthened it, took out the ends, hitched on a rudder, and when the petrol engine had developed sufficient power with a given weight, installed it, and flew."

As the wag explained: From "Middletown" drop the "town," change "iddle" to "oses," and we get "Moses"!

Page 24: "As a result of the explorations of the atmosphere made by the institution at Mount Weather, there was ready for our fighting air men at the front, immediately on our entry into the World War, a fund of useful information concerning a region that but a short time before was entirely uncharted."

These excellent data were, indeed, much used in the United States, but it would be fair to infer from the above statement that no such information was available from any other source. As a matter of fact, there were many times as much information of this kind available from the immediate seat of the war, published, and, doubtless, in every meteorological library.

Page 25: "If the aerial explorer could stop his ship and keep it at an altitude of about one and a half miles for twenty-four hours he would be startled to find that the coolest time of the period was during the daytime, not

during the night, as he had expected to find it."

No doubt, and he would be even more startled if he had first studied the records and found, as he would have, that in general the lowest temperature at that level *is* at night, or, more exactly, at 5 to 6 A.M., substantially as at the surface.

Page 40: "Ozone is highly electrified oxygen."

News, presumably, to the chemist; and in excellent keeping with the rest of the nearly two pages under the subtitle *Ozone*.

Page 53: "The music of the spheres is not a myth; the lily or the rose as it opens its petals to receive the benediction of the morning sun may give forth a veritable pæan of joy. A rose-bush may be a grander symphony than anything that Beethoven ever wrote. What to us is the invisible light may be the illumination that guides the sweep of the angels' wings."

The reviewer prefers to let his reader say it!

Page 62: "Bodies or planets without atmospheres have temperatures approaching absolute zero. . . . Our moon is an illustration."

Indeed, an excellent illustration, and it tells a very different story.

Page 124: "But early in its [air of the anticyclone] descent it gains such heat as to melt and evaporate the ice spiculæ floating at the height of the fleecy cirrus clouds; then it evaporates and clears away the moist clouds lower down and finally creates such *diathermacy* that the heat lost by radiation to a clear sky causes what we call a 'cold wave.'"

This is meteorology simplified, indeed, but at the expense of facts, logic and the laws of nature.

Page 188: "If the surface of the earth were all land, and the axis of the earth's rotation were perpendicular to the plane of the earth's orbit . . . . there would be no wind."

What, then, does the author imagine would produce a wind?

Page 190: "With a water surface there would be an atmosphere nearly if not quite saturated with vapor of water."

Assuredly not, and for reasons any meteorologist can easily supply.

Page 226: " . . . snow knee-deep to a boy of ten hardly comes up to the ankles of a man of six feet two."

This, of course, is a mere trifle, but it is typical of the inaccuracies, apart from positive errors, that crowd the book from cover to cover.

Page 287: "There is a difference of opinion among meteorologists as to whether the thunderstorm whirls about a vertical axis, like the tornado and the hurricane, or whether it rotates about a horizontal axis."

There should not be, and is not, this difference of opinion, as the thunderstorm does not whirl or rotate about any axis.

Page 287: "One may well account for the formation of the hailstone by assuming that its alternating layers of snow and ice are caused by the horizontal roll of a thunderstorm."

The author's idea as to how a hailstone could go round and round in a vertical orbit, as he assumes, and not fly out on the first turn, would be interesting.

The chapter that tells how to forecast from the daily weather map is helpful, and would have been good if only the author had refrained from attempting to explain the phenomena.

The third of the books listed for this review is notable for two things: (*a*) The number of eminent scholars (the name of one of them wrong) listed in the preface as proof-readers, contributors and "almost co-authors"; (*b*) the fact that it is being offered to the public by the Yale University Press. It is notable in these respects because each would seem to guarantee reasonable accuracy, and a definite contribution to knowledge, whereas, in large measure, its broader conceptions are mere fantasies, while its details show little regard for facts and none for physics. Surely the authors of this book must be like the Scotchman who on looking over the doctor's bill inquired: "What is this item of five pounds for?" "For the advice I gave you." "Weel," said the Scotchman, "I niver took it!"

Frequent reference is made to a companion volume, *Earth and Sun,* said to be "in press" (a poetic license, apparently) for proof of this or that startling assertion, and one would like to see this first volume before reviewing the second. However, it would seem useless to wait for an alleged proof that two and two make a dozen before expressing an opinion on the subject.

The main hypotheses of the book are:

1. " . . . that the earth's present climatic variations are correlated with changes in the solar atmosphere."

But there remains to be proved (*a*) that the solar atmosphere has, in historic times, changed to a greater extent than it has, as indicated by spots, during the past century; (*b*) that the earth's climates have in the same time similarly changed; and (*c*) that these changes were causally related. The reviewer is unaware of any conclusive, or even strongly presumptive, evidence of such changes, or relation.

2. " . . . that variations in the solar atmosphere influence the earth's climate chiefly by causing variations in temperature, but also in storminess, wind and rainfall."

The change in the average temperature that parallels a sunspot cycle is known to be small, of the order of 1° C., and a physicist would look for the other weather elements, all of which depend upon temperature, or temperature differences, to be also but little affected. But the authors of this book are not physicists, so they can boldly conjure with electricity, or electromagnetism, as a variant, as the sorcerer used to with his "abracadabra," to make good their every climatic claim, nor do they ever save the reader's confusion by calculating magnitudes for him.

3. " . . . that if the climatic conditions which now prevail at times of solar activity were magnified sufficiently, and if they occurred in conjunction with certain important terrestrial conditions of which there is good evidence, they would produce most of the notable phenomena of glacial periods."

No doubt, and if a billy-goat were big enough and hitched tandem to an engine, the two might pull a train; however, this is no proof that billy-goats used to be giants, nor that trains ever were pulled that way.

In addition to the main hypotheses, there are several others, unessential, it is said, yet obviously cherished, as they bulk large in pages, and are to be further and chiefly discussed in "Earth and Sun." Together, these fancy that whenever we come within so many billions, or hundreds of billions, of miles of a fixed star (Alpha Centauri being the latest of the guilty), its electric state sets whirling the spots on our own sun; and that these spots in turn electrically, or electromagnetically, whichever reads best, drive our weather cyclones off their more peaceful paths and whip them up to higher speed and deeper intensity, thereby bringing on the storm and stress of an ice age, and, by shaking loose many a stalled earthquake, building the mountain chain. And there is a table, too, that conveniently tells us at what distance this and that type of fixed star would, in the above obvious manner, glaciate our globe.

The limit to Jules Verne's meteorology was the green ray, hence one can not but sympathize with the centenarian who said: "If the world continues to progress during the next hundred years as fast as during the last, I fear I may not keep up with it."

There are also numerous statements that range from the provokingly loose to the positively false, such as, among many others:

Page 8, and elsewhere: "The temperature of empty space is the absolute zero." This is an old stereotyped formula that, literally, is without meaning. If we agree that it shall mean the temperature to which a small object would come if placed there, then, to be at all definite, we must specify where the place is with reference to other bodies, and what the object is, conditions that would provide a range of thousands of degrees Centigrade, but in no case the absolute zero.

Page 9: " . . . the two most critical of all possible temperatures, namely, the freezing point of water, 0° C., and the temperature where water can dissolve an amount of carbon dioxide equal to its own volume." Passing over the questionable use of "where" in this quotation, and the vague concept implied by an amount equal to a volume, and assuming that in this case "amount" means volume, one is still puzzled to know why this *exact* equality, a function of both temperature and pressure, is so vital.

Page 12: "No other known compounds (than those formed by water and carbon dioxide) can give off or take on atoms without being resolved back into their elements." How about the numerous "-ous" and "-ic" compounds, for instance?

Page 12: " . . . the boiling point, where all water finally turns into vapor." Must we,

then, infer that a puddle will not dry up unless it is heated to the boiling point? The statement is vague also in other respects.

Pages 21-22: Here the idea is advanced that with greatly extended oceans the temperature difference from equator to poles would become much less and both the trade winds and the westerlies stronger. This might pass in a dream, but when awake we are confronted by the fact that the strength of these general winds, and most others, is proportional to the horizontal pressure gradient, and that this in turn is proportional, in general, to the corresponding temperature gradient. Perhaps the authors should be congratulated on their ability to keep their cake and eat it too!

Page 35: " . . . the hypothesis (Croll's) calls for the constant and frequent repetition of glaciation at absolutely regular intervals." It calls for regularly recurring advances and retreats of the ice front during irregularly recurring glacial epochs.

Page 48: Here the volcanic dust hypothesis is dismissed with the assertion that the Pleistocene glacial period, if so caused, would have required fully 75,000 volcanic explosions of the Krakatoa type, a far greater number than field data allow us to assume.

This would, indeed, be a staggering blow but for the fact that, in reality, the hypothesis does not demand even one in a hundred of this number.

Pages 51-63: The whole of this chapter, "The Solar Cyclonic Hypothesis," has so little and doubtful statistical support, and to such an extent explains (?) the little known by the wholly unknown, that any detailed criticism would be both tedious and useless. It can be recommended to those only who are fond of the curiosities of "cloister" science.

Page 113: "The marked increase in the number of tropical cyclones which accompanies increased solar activity (sun spots) . . . ." But in "Hurricanes and Tropical Revolving Storms," published by the British Meteorological Office, 1922, it is shown that no such relation exists in any part of the world, except, perhaps, in the region of Mauritius, and even there not for the severer storms.

Page 115: " . . . at times of many sunspots, as Kullmer has shown, the storm track tends to be drawn poleward, perhaps by electrical conditions." Professor Henry has explained, *Monthly Weather Review,* 49, p. 283, 1921, that the data used by Kullmer do not justify his conclusions. Then, too, why assert that such a shift, if it occurs, may be due to electrical actions? One gets impatient with assertions that are not backed up by logic and calculations.

Page 116: " . . . ice . . . is much more transparent to heat [than is water]." One must be excused for asking for the authority for this statement, especially as Bode, *Annalen der Physik,* 30, p. 326, 1909, found the difference, if any, to be very small.

Page 136: This page carries one of the few numerical calculations in the book—namely, 10,000/300; and the answer given is 40.

Page 174: "The existing abnormal changes, which we call weather, have their origin chiefly, if not entirely, in the variations of solar radiation." This is taken from another author, but adopted without question. It prompts one to ask whether, for instance, the eddies in the Niagara Gorge are due to variations in the amount of water passing over the falls.

Page 231: "Some such temperature (-273°C.) prevails a few miles above the earth's surface, beyond the effective atmosphere." Absolutely not, and far from it, as everyone knows who has any acquaintance with the theory of the isothermal condition of the upper air.

As already stated, the above quotations from this book are only samples of the many shocks and surprises it contains for any one accustomed to accuracy and to the notion that every effect must have had an adequate cause.

But bad as these books are they are only typical of that huge mass of toxic mental food so persistently thrust upon the public. "Yes, I know that," is the ready and common response, "but what can be done about it?" Anything we sufficiently want done. The packer is no more a chemist or bacteriologist or other kind of scientific specialist than is the publisher, and yet we have found a way, fair to all concerned, that insures to us reasonable purity and wholesomeness of our physical food; and the same can and should be done for our mental food, though better done by a different method.

W. J. HUMPHREYS

SPECIAL ARTICLES

THE INITIAL ENERGY OF THERMIONIC ELECTRONS

MEASUREMENTS of the initial energy of thermionic electrons have been made by Richardson and Brown, Richardson, Schottky and Sih Ling Ting, working under Richardson.[1] With the exception of Ting's work these experiments substantially confirmed the belief that electrons are emitted from a hot body with velocity components distributed according to Maxwell's law for a gas having the temperature of the emitting surface and molecular weight equal to that of the electrons. The measurements of Ting, however, were quite at variance with the former results, and his experimental conditions were apparently better than those under which Richardson had worked.

The present investigation was undertaken with the hope of getting more reliable data than have been hitherto obtained and with the expectation of carrying out measurements upon the distribution function over a very wide energy range. The experimental method of Schottky was adopted. In order greatly to extend the range of the measurements, various experimental refinements have been found necessary, but the method is essentially that of Schottky's work.

The source of the thermionic electrons is a straight tungsten filament lying along the axis of a cylindrical electrode. The experiment consists in the determination of the fraction of the total number of electrons from this filament which possesses sufficient initial energy to move against an opposing electric field and to arrive at a small opening in the cylinder near its center. This fraction is determined as a function of the potential between filament and cylinder, emission currents being measured only during short intervals of time during which the entire surface of the filament is at the same potential.

[1] Richardson and Brown—Phil. Mag. 16 p. 353 (1908).

Richardson—Phil. Mag. 16 p. 890 (1908); 18 p. 681 (1909).

Schottky—Ann. d. Phys. 44 P. 1011 (1914).

Sih Ling Ting—Roy. Soc. Proc. 98 P. 374 (1920-21).

In the former work upon this subject the fastest electrons measured have had energies corresponding to a potential difference of about 2 volts. In the present experiments the fastest electrons measured have energies corresponding to about 5.35 volts. This is at a filament temperature of 2475° K. giving a saturation emission of $.24 \times 10^{-3}$ amp. Measurements have yet to be made at considerably higher temperatures and it seems probable that the distribution function will be investigated as far as "6-volt electrons" at these higher temperatures.

If the emitted electrons leave the filament at the temperature T with velocities distributed according to Maxwell's law the fraction of the saturation current which reaches the surrounding cylinder at a potential φ negative to the filament is given by,

$$\frac{i}{i_0} = \frac{2}{\sqrt{\pi}}\left\{\sqrt{\frac{\varphi e}{kT}}\,\varepsilon^{-\frac{\varphi e}{kT}} + \int_{\sqrt{\frac{\varphi e}{kT}}}^{\infty} \varepsilon^{-x^2}\,dx\right\} \tag{1}$$

Here e is the electronic charge and k is Boltzmann's gas constant. The derivation of this expression, which was given by Schottky, assumes the diameter of the filament small in comparison with the diameter of the cylinder and the elimination of end effects at the extremities of the latter. In the present experiments these requirements are satisfactorily met. Furthermore, this equation holds only for values of φ so large that the potential of the collecting cylinder is more negative than the potential of any region between it and the filament.

The experimental data which have been obtained are in excellent agreement with this theoretical equation. Data have been obtained connecting i/i_0 and φ at eight different temperatures ranging from 1440° K. to 2475° K. These temperatures are determined with fair accuracy. At the lower temperatures the data are given throughout by the above equation within the limits of error of the measurements. At the higher temperatures the data deviate from the theoretical relation only for values of φ near zero, and in the direction to be anticipated from the mutual repulsion of the elec-

trons in the space between the electrodes. No one of the eight sets of data is satisfactorily represented by equation (1) if the value of the temperature T is taken 10 per cent. in error.

The range of the measurements which have been made thus far is as follows:

1440° K.—1.0×10^{-11} amp. saturation current to 1.0×10^{-14} amp. at 1.02 volts.

2475° K. — $.24 \times 10^{-3}$ amp. saturation current to 2.0×10^{-14} amp. at 5.35 volts.

Data are still to be taken at temperatures below 1440° K. and above 2475° K., and at all temperatures the range of the measurements may be somewhat extended by further refinements to eliminate some of the disturbing factors which are still present.

L. H. GERMER

RESEARCH LABORATORIES OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY, INC. AND THE WESTERN ELECTRIC COMPANY, INC.

MARCH 5, 1923

THE AMERICAN PHYSIOLOGICAL SOCIETY

THE thirty-fifth annual session of the American Physiological Society met at the University of Toronto, Toronto, Canada, December 27, 28 and 29, 1922. The scientific meetings were held in the physiological lecture room of the University of Toronto. There were six scientific sessions lasting through three days with over seventy-five titles. Two of these sessions were combined programs in which the physiologists joined with the biochemists, pharmacologists and pathologists of the Federation of American Societies for Experimental Biology. Of the sessions the combined program of the last afternoon discussing various aspects of the internal secretion of the pancreas and its physiological rôle in the body aroused the greatest enthusiasm and the largest general attendance. The individual programs as a whole were of high quality and of the usual variety, covering all fields of physiological endeavor. The American physiologists are justly proud of the high standard of the research contributions.

The most important business transacted at the annual session was the following:

Dr. William T. Porter, of Harvard University, continued his research fellowship grant of $1,200. The council announced the appointment to this fellowship for the year 1922-23 of Miss Florence B. Seibert. The occupant of the fellowship under the terms of the grant is privileged to choose any research laboratory in which to carry forward the researches. Miss Seibert elected to work under the guidance of Professor L. B. Mendel, of Yale University.

It was announced by the council that Dr. William T. Porter had donated to the society all the remaining volumes and plates of the *American Journal of Physiology* issued under his editorship. This generous grant puts the society in possession of all the reserve sets of the *American Journal of Physiology*.

The council reported before the society that the *American Journal of Physiology*, now in its sixty-fourth volume, and *Physiological Reviews*, now in its third volume, were both at the present time self-supporting with a sufficient credit balance to maintain publication on a very stable basis. The commendable financial condition of the journals is largely credited to the conservative and skilful financial management of the managing editor, Dr. Donald R. Hooker, of Baltimore. As an expression of appreciation by the membership of the society as a whole, Dr. Hooker was given an enthusiastic vote of thanks for his unselfish and tireless labors in maintaining not only the financial success but the high research ideals and standards of publication in the journals of the society.

Dr. Donald R. Hooker was elected managing editor of the *American Journal of Physiology* for the year 1923. The board of editors for *Physiological Reviews* designated for 1923 consists of:

William H. Howell, Johns Hopkins School of Hygiene, *chairman*; Donald R. Hooker, Baltimore; J. J. R. Macleod, University of Toronto; L. B. Mendel, Yale University; Reid Hunt, Harvard University; H. Gideon Wells, University of Chicago; Walter J. Meek, University of Wisconsin.

Professor A. J. Carlson, University of Chicago, was nominated representative of the society on the National Research Council.

The following scientists were elected to membership in the society:

Thomas Addis, M. D., professor of medicine, Stanford University.

Janet Howell Clark, A.M., Ph.D., associate in physiological hygiene, School of Hygiene, Johns Hopkins University.

Roger Sanford Hubbard, A.M., Ph.D., biological chemist, Clifton Springs Sanitarium, Clifton Springs, N. Y.

David Rapport, M.D., fellow of the National Research Council, 1922-23.

M. H. Rees, A.M., Ph.D., M.D., professor of physiology and pharmacology, University of Colorado.

Norman B. Taylor, M.B., M.R.C.S., F.R.C.S., assistant professor of physiology, Toronto University.

J. Earl Thomas, M.D., associate professor of physiology, St. Louis University.

The officers elected for the year 1923 are:

President, Anton J. Carlson, University of Chicago.

Secretary, Charles W. Greene, University of Missouri.

Treasurer, Joseph Erlanger, Washington University, St. Louis.

Arnold B. Luckhardt, University of Chicago, and John R. Murlin, University of Rochester, were elected to membership in the council of the society.

The following resolutions were presented and voted by the society:

Resolved: That the American Physiological Society strongly approves the full international character of the Physiological Congress at Edinburgh, and that we heartily support the efforts of the organization committee in that attitude.

Resolved: That the Physiological Society extend an invitation to the International Physiological Congress of 1926 to meet in America.

Resolved: That the American Physiological Society express to the local committee and especially to its chairman, Dr. Henderson, their appreciation of the excellent management of the meetings and of the delightful entertainment provided, which place the Toronto meeting among the most successful and enjoyable in the history of the society.

SCIENTIFIC PROGRAM

The topics rendered in the scientific program are completely listed below:

The significance of the dual function of hemoglobin in relation to the mechanism of the chemical regulation of respiration: ROBERT GESELL, Washington University, St. Louis.

Circulatory changes in experimental dehydration: N. M. KEITH, Mayo Foundation.

The effect of anoxemia on metabolism: E. J. KOEHLER (by invitation), E. H. BRUNQUIST (by invitation), and A. S. LOEVENHART, University of Wisconsin.

Some effects of strychnine and physostigmine upon the blood picture: C. W. EDMUNDS and PUTNAM C. LLOYD (by invitation), University of Michigan.

On the existence of a hitherto unknown nutritive factor essential for reproduction: H. N. EVANS and K. SCOTT BISHOP (by invitation), University of California.

A comparison of the effects of the injection of gum acacia solution and of the transfusion of blood on the oxidative power of the brain as indicated by alterations in temperature after the injection of adrenalin: GEORGE W. CRILE, AMY F. ROWLAND (by invitation), and S. W. WALLACE (by invitation), Cleveland Clinic.

The respiratory quotient and basal metabolism following removal of the liver and glucose injection: F. C. MANN, Mayo Foundation.

On the physical properties, daily amount and rate of secretion of human pancreatic juice: A. B. LUCKHARDT, FRED STANGL (by invitation), and F. C. KOCH (by invitation), University of Chicago.

Respiratory exchange studies under ether narcosis: T. K. KRUSE, University of Pittsburgh.

The basal metabolism of girls from eleven to fourteen years of age: MARY SWARTZ ROSE and GRACE MACLEOD (by invitation), Teachers College, Columbia University.

On the local reflex mechanism and the nature of the segmental contractions in the small intestine: ALBERT KUNTZ (by invitation), and J. EARL THOMAS (by invitation), St. Louis University.

Electrical conductivity of living tissues as affected by the surrounding medium: S. C. BROOKS (by invitation), Washington, D. C.

Some X-ray studies on the heart: W. J. MEEK and J. A. E. EYSTER, University of Wisconsin.

The physiological action of ionizing radiations: ALFRED C. REDFIELD, Harvard Medical School.

On the cause of the initial rise in the basal metabolic rate during fasting: MARGARET KUNDE (by invitation), Chicago.

Influence of gonad hormones on the seminal vesicles: N. F. FISHER (by invitation), Chicago.

Effect of muscular activity on perfused adrenin: R. G. HOSKINS and E. P. DURRANT (by invitation), Ohio State University.

Effect of digestive enzymes on pituitary extract action: MAURICE H. REES (by invitation) and RICHARD WHITEHEAD (by invitation), University of Colorado.

Neuro-muscular activity in cretinoid sheep: SUTHERLAND SIMPSON and HOWARD S. LIDDELL (by invitation), Cornell University.

The cost of work in exophthalmic goiter: H. S. PLUMMER (by invitation) and W. M. BOOTHBY, Mayo Foundation.

The effect of thyro-parathyroidectomy and parathyroidectomy at 100 days of age on the growth of male albino rats: F. S. HAMMETT, Wistar Institute.

The pathogenesis of parathyroid tetany: L. R. DRAGSTEDT, University of Chicago.

The control and cure of parathyroid tetany: A. B. LUCKHARDT, P. ROSENBLOOM (by invitation), J. BLUMENSTOCK (by invitation), and B. GOLDBERG (by invitation), University of Chicago.

Increase in size at moulting: J. P. BAUMBERGER and J. M. D. OLMSTED, Stanford University.

The calorigenic action of adrenalin chloride: W. M. BOOTHBY and I. SANDIFORD (by invitation), Mayo Foundation.

The supposed relation of the adrenals to reflex volume changes in the denervated limb. (Lantern): G. N. STEWART and J. M. ROGOFF, Western Reserve University.

The supposed relation of the adrenals to the blood-pressure changes induced by cerebral anemia. (Lantern): J. M. ROGOFF and HELEN C. COOMBS, Western Reserve University and Columbia University.

Retinal mean local sign; a new view of the relation of the retinal mosaic to visual perception: F. W. WEYMOUTH, EMELIE E. ANDERSON (by invitation) and H. L. AVERILL (by invitation), Stanford University.

Chemical effects produced by passing electric currents through thin artificial membranes of high electrical resistance: R. S. LILLIE and S. E. POND (by invitation), Nela Research Laboratory.

Some physiological effects of saccharin: A. J. CARLSON, University of Chicago.

Delay in the response to the second of two stimuli in nerve, and in the nerve-muscle preparation: ALEXANDER FORBES, F. R. GRIFFITH (by invitation) and L. H. RAY (by invitation), Harvard Medical School.

Some characteristics of the action current in nerve: HERBERT S. GASSER and JOSEPH ERLANGER, Washington University, St. Louis.

Rapid intestinal absorption, without digestion, of a complex protein substance—tissue fibrinogen: C. A. MILLS, University of Cincinnati.

The effect of formaldehyde upon the vitamin content of milk: A. M. BLEILE and R. J. SEYMOUR (by invitation), Ohio State University.

The excitation of gastric secretion by application of substances to the duodenal mucosa: A. C. IVY and G. B. MCILVAIN (by invitation), Loyola University.

The behavior of the empty stomach in the mollusca: T. L. PATTERSON, Detroit College of Medicine and Surgery.

Study of pulse wave velocity in arteriosclerosis: JANE SANDS (by invitation), University of Pennsylvania.

The all-or-none character of minimal flexion reflex contractions in the spinal cord: E. L. PORTER, Western Reserve University.

The influence of insomnia, fasting, etc., on the kneejerk: MARY A. M. HAUPT (by invitation) and N. KLEITMAN (by invitation).

Experiments on the mechanism of action of insulin: J. J. R. MACLEOD, N. A. MCCORMICK (by invitation), E. C. NOBLE (by invitation) and K. O'BRIEN (by invitation), University of Toronto.

Quantitative parallelism of effect of insulin in man, dog, rabbit: F. H. BANTING (by invitation), C. H. BEST (by invitation), G. M. DOBBIN (by invitation) and J. A. GILCHRIST (by invitation), University of Toronto.

Delayed manifestation of the physiological effects of insulin following the administration of certain pancreatic extracts: J. B. COLLIP, University of Alberta.

Methods of administration of insulin: F. G. BANTING (by invitation), G. M. DOBBIN (by invitation) and MISS S. CAIRNS (by invitation), University of Toronto.

Methods of administration of pancreatic extracts to diabetic animals and man: C. CLYDE SUTTER (by invitation), C. B. F. GIBBS (by invitation) and JOHN R. MURLIN, University of Rochester.

The physiological assay of insulin: G. S. EADIE (by invitation), N. A. MCCORMICK (by invitation), MISS K. O'BRIEN (by invitation) and J. J. R. MACLEOD, University of Toronto.

The effect of voluntary contractions and of dermography on the number of visible capillaries of the human skin: G. N. TSANG, University of Minnesota.

PAPERS BY TITLE

Measurement of the circulation rate in man: H. W. HAGGARD and Y. HENDERSON, Yale University.

On Weichardt's supposed fatigue toxin: FREDERIC S. LEE and B. ARONOVITCH (by invitation), Columbia University.

The chemical regulation of the activities of the human kidney: E. F. ADOLPH, University of Pittsburgh.

Some conditions determining adrenal secretion:

F. A. HARTMAN, University of Buffalo.

Some effects of adrenalin on the perfused bull-frog heart: C. I. REED (by invitation), University of Kansas.

On the concentration of proteins in tissues: E. J. COHN, Harvard University.

The site of the anaphylactic reaction of the uterus: O. O. STOLAND, University of Kansas.

Certain factors affecting filtration through berkefeld candles: STUART MUDD, Harvard University.

Some effects of various environmental temperatures upon the blood of dogs: E. L. SCOTT and F. B. FLINN (by invitation), Columbia University.

Causation of the differential blood pressure in aortic regurgitation: H. C. BAZETT, University of Pennsylvania.

Bio-physical studies of the effects of adrenalin upon the temperature of the brain and of other organs and tissues: GEORGE W. CRILE and HUGO FRICKE (by invitation), Cleveland Clinic.

The motile state of the stomach of the monkey in hunger: T. L. PATTERSON and JESSIE ILLENDEN (by invitation), Detroit College of Medicine and Surgery.

The electrocardiogram in fasting dogs: H. C. LAWSON (by invitation), S. MORGULIS and A. E. GUENTHER, University of Nebraska.

On the relations of cortical and sub-cortical cerebral lesions to spastic phenomena in the marsupial: FRED T. ROGERS, Baylor University.

Relation of the ovary to the gravid uterus in the aplacental opossum: CARL HARTMAN, University of Texas.

Removal of the semicircular canals in baby chicks: L. B. NICE and C. L. FURROW (by invitation), University of Oklahoma.

Experiments on migration of bacteria: SHIELDS WARREN (by invitation) and STUART MUDD, Harvard University.

Administration of lactic acid following removal of the liver: F. C. MANN and T. B. MAGATH (by invitation), Mayo Foundation.

Certain features of the physiology of growth as illustrated by the lamellibranch tibela: F. W. WEYMOUTH, Leland Stanford Junior University.

A note on the control of the cardia in man: A. J. CARLSON, Chicago.

The influence of the cerebrum and cerebellum on decerebrate and ether rigidity: J. M. D. OLMSTED and W. P. WARNER (by invitation), Toronto.

Distribution of vitamin A in the digestive secretions and urine: ETHEL COOPER (by invitation), Chicago.

The after effects of prolonged fasting on gastric secretions: MARGARET M. KUNDE (by invitation), Chicago.

Electric capacity of the brain and other animal tissues: GEORGE W. CRILE and C. NUSBAUM (by invitation), Cleveland Clinic.

Heparin, an anticoagulant: W. H. HOWELL, Johns Hopkins University.

The effect of gymnasium exercises and athletic contests on the blood catalase: W. E. BURGE, University of Illinois.

DEMONSTRATIONS

Demonstration of the turning and caloric reactions on the isolated eye muscles of the rabbit, with some theoretical remarks: R. BARANY (by invitation), University of Upsala.

Horizontal eye movement produced from the cortex of the vermis in the rabbit: R. BARANY (by invitation), University of Upsala.

A simplified automatic and bloodless method of recording the volume-flow of blood: ROBERT GESELL, Washington University.

Filtration through frog-skin: TORALD SOLLMANN, Western Reserve University.

A new method for determining the clotting time of the blood: C. A. MILLS and M. F. PETERSON (by invitation), University of Cincinnati.

A method of estimating the thickness of cell membranes: HUGO FRICKE (by invitation), Cleveland Clinic.

Cinema demonstration of growth and gait of cretinoid sheep: H. S. LIDDELL (by invitation) and SUTHERLAND SIMPSON, Cornell University.

An apparatus for regulating the body temperature during operative procedures: MUNROE A. MCIVER (by invitation), Harvard Medical School.

Note on a method of making simultaneous fast and slow drum records of fatigue: F. M. BALDWIN, Iowa State College.

The silver non-polarizable electrode adapted for use in electrocardiography: M. DRESBACH, Albany Medical College.

A gas analysis apparatus for use with chamber respiration apparatus: THORNE M. CARPENTER, Carnegie Nutrition Laboratory.

Hypoglycæmic symptoms: J. J. R. MACLEOD, University of Toronto.

Some small gas analysis apparatus: J. J. R. MACLEOD, University of Toronto.

Experiment showing effect of stretching on isotonic, isometric, cardiac muscle contractions: N. S. CLARK (by invitation) and V. E. HENDERSON, University of Toronto.

Some new experimental devices: D. E. JACKSON, University of Cincinnati.

CHARLES W. GREENE, *Secretary*